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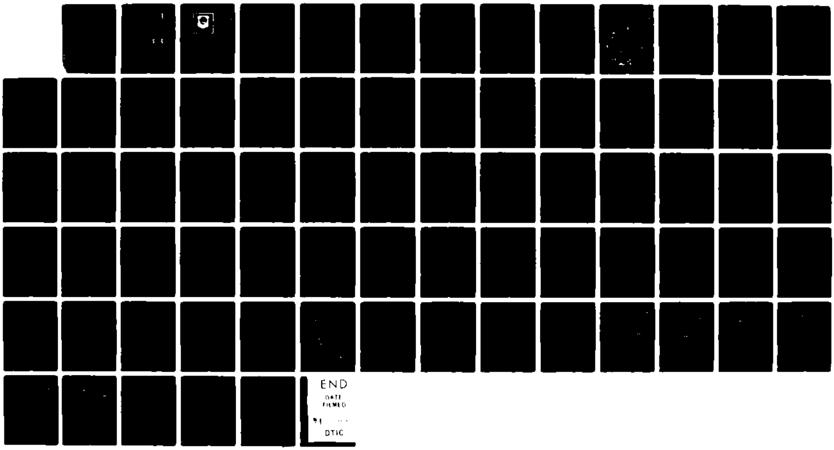

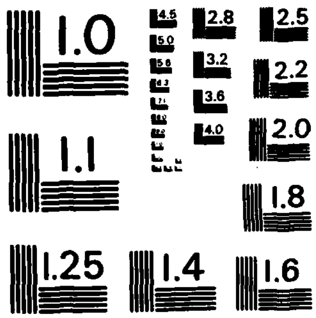
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TERMINAL FORECAST REFERENCE NOTEBOOK

FOR

RAF ALCONBURY, ENGLAND

Published By

DETACHMENT 36
28TH WEATHER SQUADRON
2D WEATHER WING (MAC)
UNITED STATES AIR FORCE

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DEPARTMENT OF THE AIR FORCE
Detachment 36, 28th Weather Squadron
RAF Alconbury, England

TFRN

01 January 1983

TERMINAL FORECAST REFERENCE NOTEBOOK

This Terminal Forecast Reference Notebook (TFRN) contains information and guidance for forecasting the terminal weather at RAF Alconbury. It applies to all forecasters assigned to Detachment 36, 28th Weather Squadron.

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This TFRN supersedes TFRN 1 June 1977.

TABLES

NOMOGRAMS

INDEX OF TERMINAL FORECAST REFERENCE FILE

TFRN	FORECAST WORKCENTER
LAFP	" "
RUSSWO	" "
Conditional Climatology Tables	" "
Catalogue of European Large Scale Weather Types	" "
Upslope-Lee Effect Charts	" "
European Theater Weather Orientation	TECHNICAL LIBRARY
AWS Technical Reports	" "
2WW Technical Notes	" "
AWS 105 Series Publications	ADMIN WORKCENTER
AFGWCP 105-1, Volumes I, II, III	" "

SECTION 1 - LOCATION AND TOPOGRAPHY

RAF Alconbury is located 40NM north of London, 30NM south-southwest of the Wash (a large shallow bay of the North Sea), and southwest of the North Sea. Peterborough, a major industrial city, is located about 12 miles to the north. The exact geographic coordinates are 52°22'N and 00°13'W (see figure 1-1, Local Area Map). The airfield sits on the southern end of a low hill and has an elevation of 160 feet above mean sea level (see figure 1-2, Meteorological Instrumentation Map).

The countryside surrounding the base is generally flat or slightly rolling farm and woodlands. The region gradually slopes to the Wash through the Fens, a boggy marshland. East through southeast, farmland slopes to the southern North Sea and Thames estuary. Small hills, 400 to 500 feet are located about 25 to 30 miles south and the Northampton uplands rise 1200 to 1500 feet, 20 miles to the west. The nearest mountains are the Welsh mountains, 90 miles to the west, with elevations up to 3000 feet above mean sea level. The Pennine chain, 100 miles northwest in northern England, also rise to 2000 to 3000 feet.

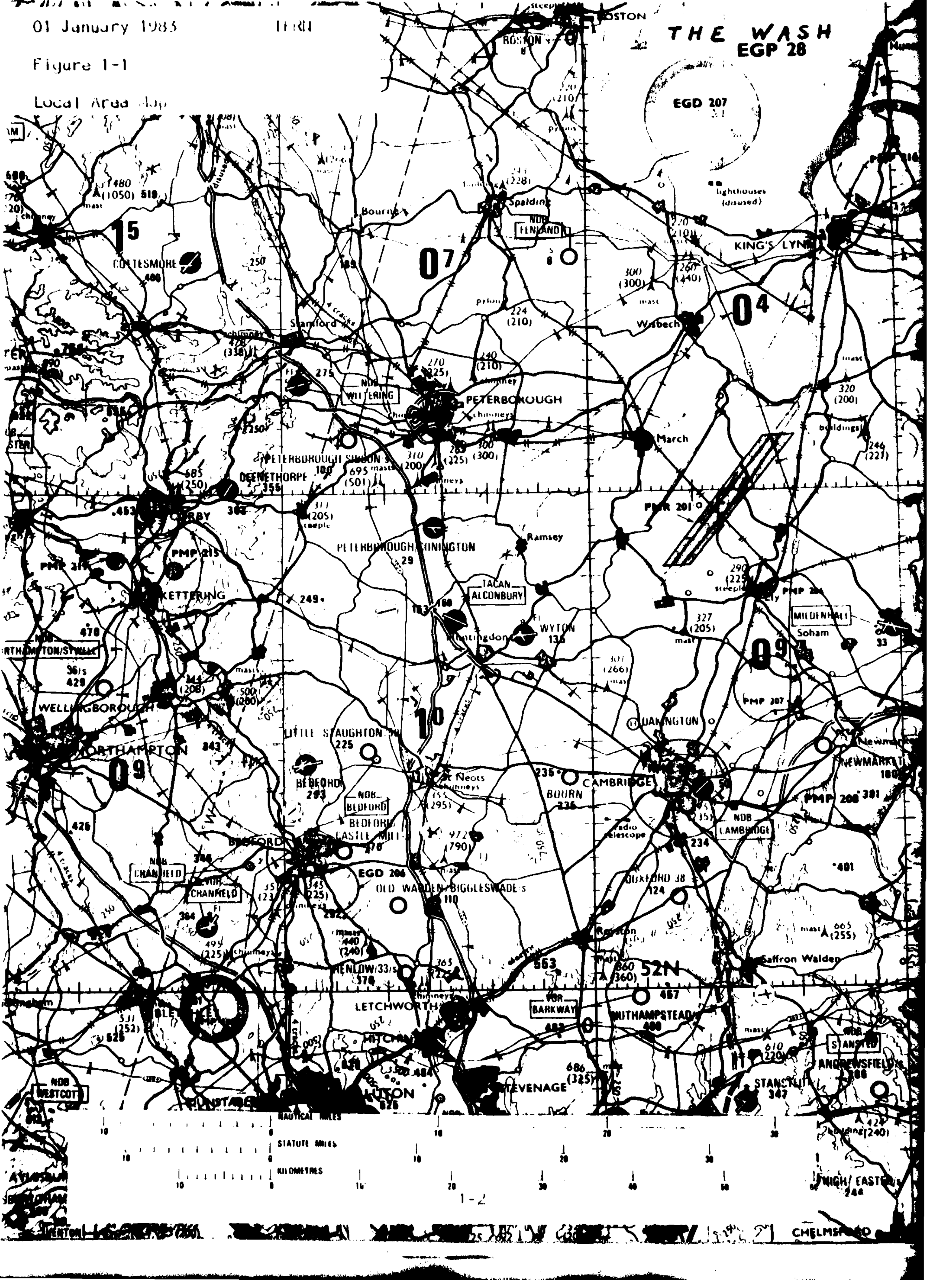
The geographical situation of this base removes it somewhat from the full influence of the ocean. There are no major rivers in the vicinity of the base, and the nearest major water body is the Wash. Under certain conditions, local weather is determined completely by this proximity to the Wash.

RAF Alconbury is near the upstream border of the European Forecast Unit's charts and there is an upstream data void for the base. Due to the gross scale and smoothing, specific analysis required to supplement these products is identified in the detachment Local Analysis and Forecasting Program.

01 January 1985 TERN

Figure 1-1

Local Area Map



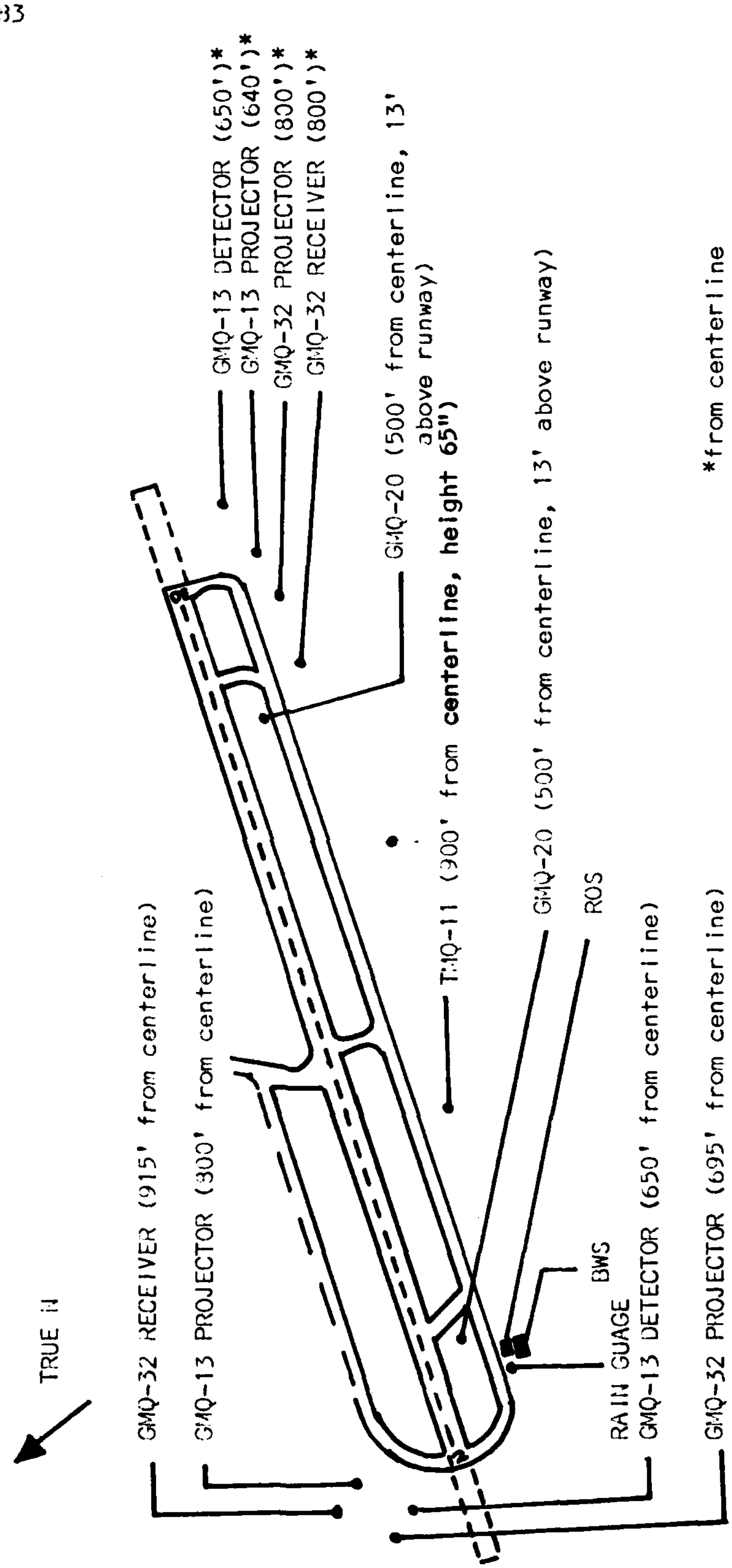


FIGURE 1-2. METEOROLOGICAL INSTRUMENTATION MAP
(RAF Alconbury--not to scale)

SECTION 2 - CLIMATIC AIDS

This section contains climatic aids tailored to support operational requirements. The data was extracted from the 30 Nov 77 Revised Uniform Summary of Surface Weather Observations (RUSSWO), and daily climatology logs (temperature, precipitation, and wind gust data), January 1973 through December 1982.

Table 2-1. Selected Climatology (Temperature & Precipitation)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
TEMPERATURES (°F):													
EXTREME MAX	59	63	77	75	80	93	93	91	82	78	65	62	93
MEAN MAX	43	44	48	54	61	67	69	69	65	58	49	44	56
DAILY MEAN	39	40	43	47	53	59	62	61	58	52	44	40	50
MEAN MIN	34	35	36	40	45	50	53	53	50	45	38	35	43
EXTREME MIN	1	14	11	23	31	35	38	43	33	28	21	16	1
PRECIPITATION (INCHES): Noté : Includes liquid equivalent of snowfall.													
LIQUID													
EXTREME MAX	3.27	3.58	5.08	3.31	4.21	5.06	5.47	4.38	3.83	4.48	4.30	3.62	------
MEAN	1.90	1.34	1.62	1.57	1.70	2.05	2.17	2.09	2.15	1.82	2.03	1.85	22.28
EXTREME MIN	.64	.08	.17	.00	.47	.10	.03	.41	.03	.16	.63	.44	------
24-HOUR MAX	.92	.83	1.64	1.23	1.35	2.24	2.08	2.07	1.41	1.29	1.05	1.23	------
SNOWFALL													
EXTREME MAX	11.2	14.0	7.4	1.5	T*	T	---	---	---	---	5.0	11.6	------
MEAN	2.3	2.1	1.2	.3	T	T	---	---	---	---	.4	1.5	------
EXTREME MIN	0	0	0	0	0	0	---	---	---	---	0	0	------
24-HOUR MAX	3.6	5.3	7.3	1.1	T	T	---	---	---	T	3.7	7.4	------

*TRACE

SOURCE: RUSSWO, 30 Nov 77 and Daily Climatology Logs (January 78 - December 82)

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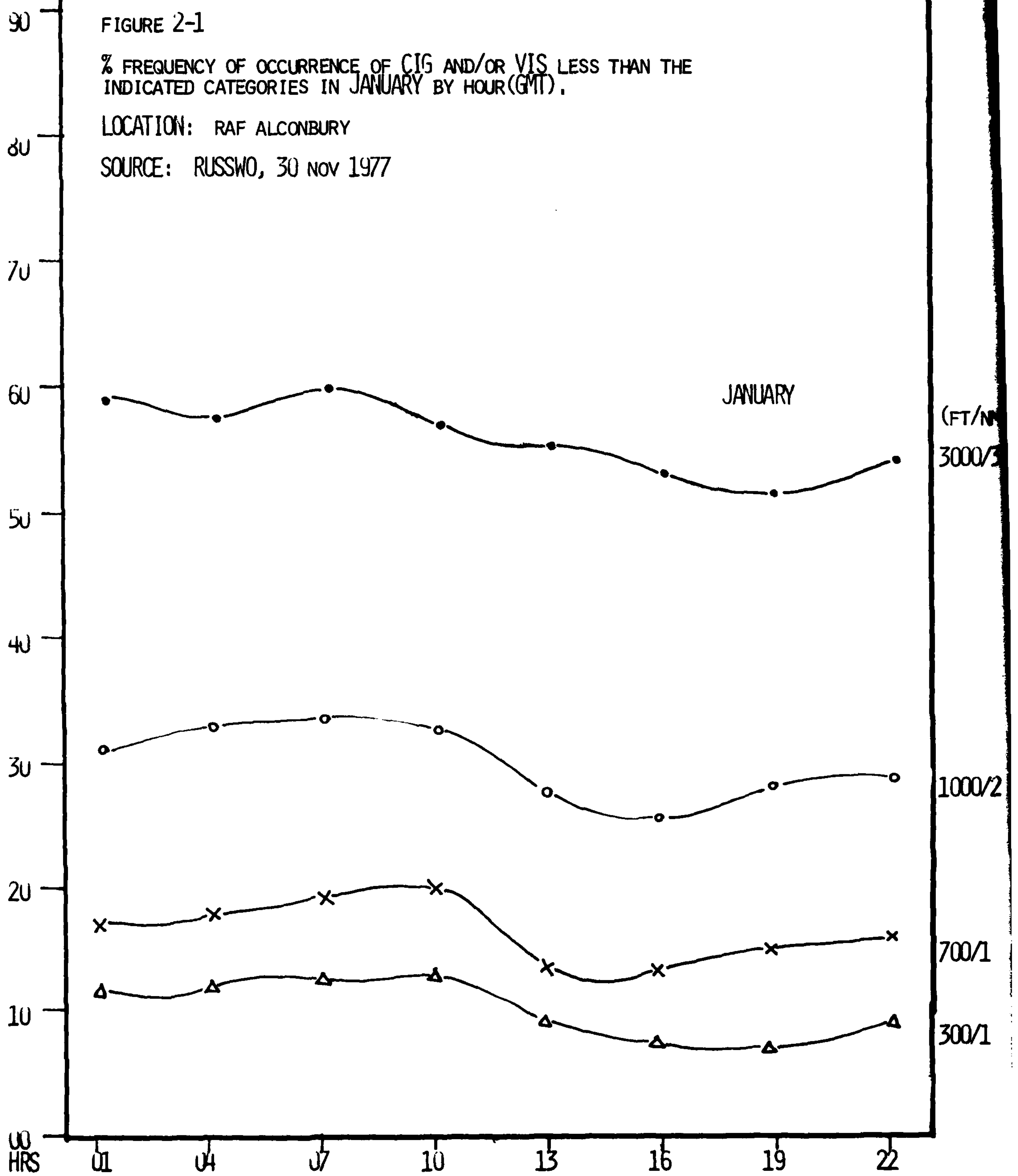
FIGURE 2-1

% FREQUENCY OF OCCURRENCE OF CIG AND/OR VIS LESS THAN THE INDICATED CATEGORIES IN JANUARY BY HOUR(GMT).

LOCATION: RAF ALCONBURY

SOURCE: RUSSWO, 30 NOV 1977



01 JANUARY 1983 TFRN

FIGURE 2-2

% FREQUENCY OF OCCURRENCE OF CIG AND/OR VIS LESS THAN THE INDICATED CATEGORIES IN FEBRUARY BY HOUR (GMT).

LOCATION: RAF ALCONBURY

SOURCE: RUSSWO, 30 NOV 1977

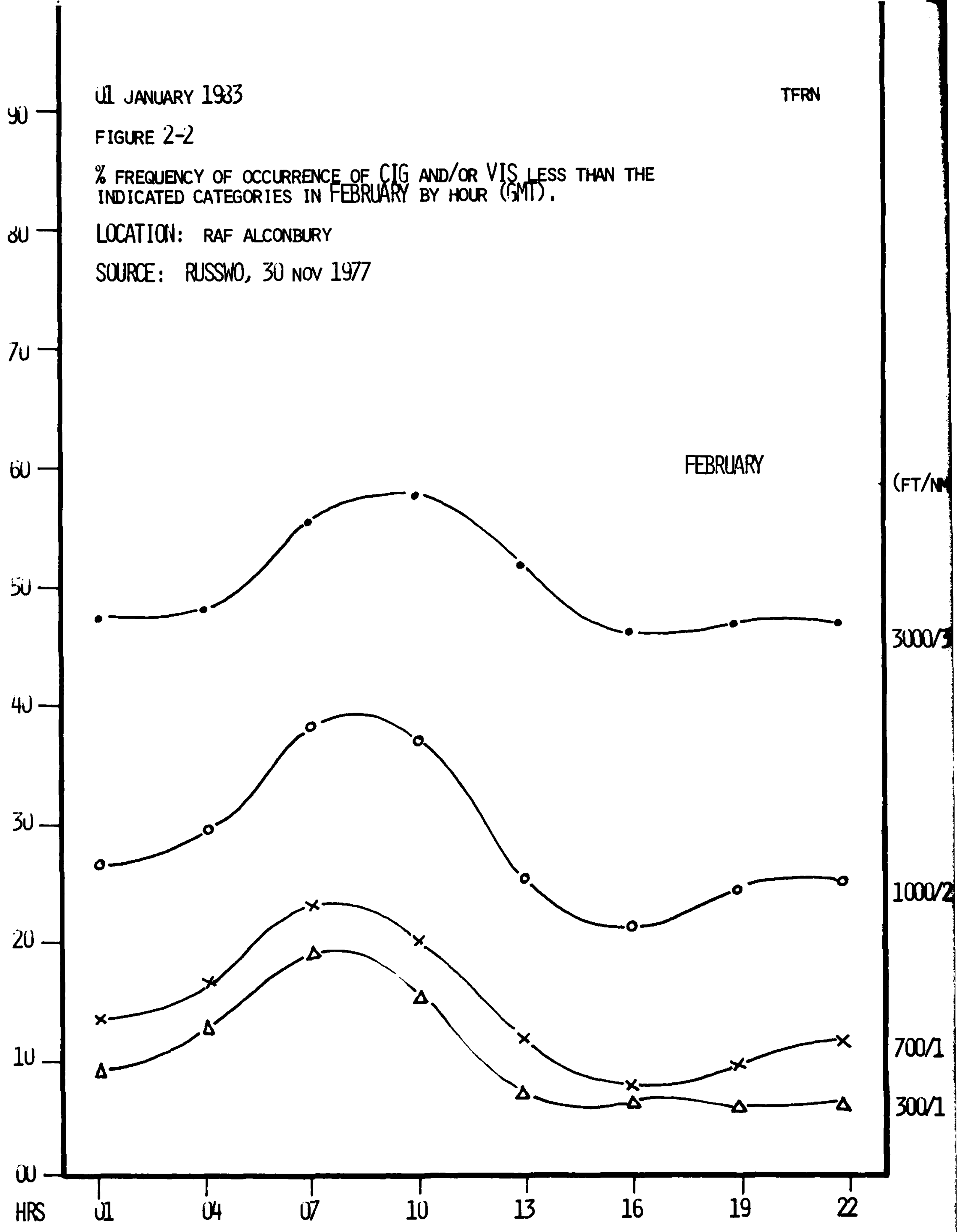


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FIGURE 2-3

% FREQUENCY OF OCCURRENCE OF CIG AND/OR VIS LESS THAN THE INDICATED CATEGORIES IN MARCH BY HOUR (GMT).

LOCATION: RAF ALCONBURY

SOURCE: RUSSWO 30 NOV 1977

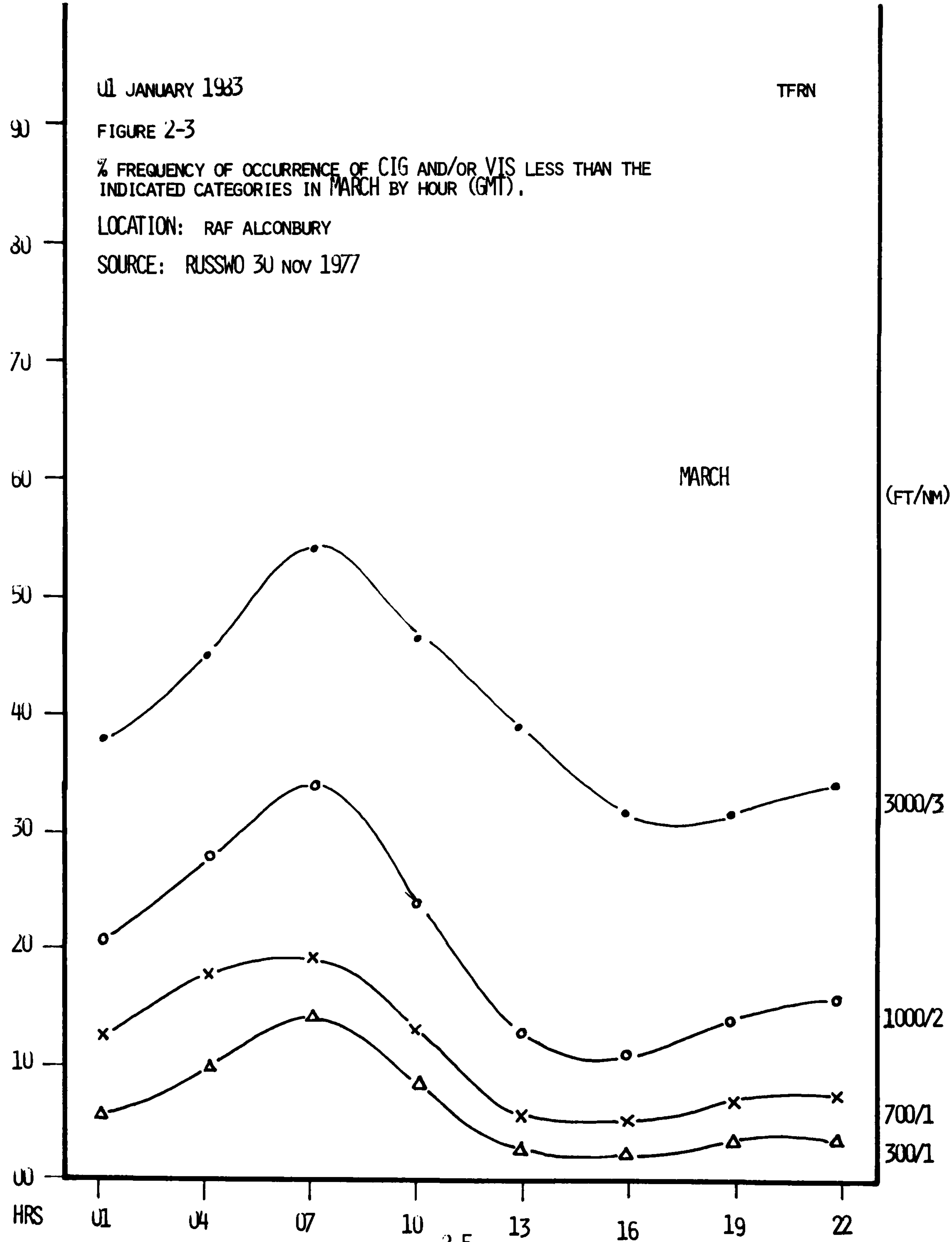

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FIGURE 2-4

% FREQUENCY OF OCCURRENCE OF CIG AND/OR VIS LESS THAN THE INDICATED CATEGORIES IN APRIL BY HOUR (GMT).

LOCATION: RAF ALCONBURY

SOURCE: RUSSWO, 30 NOV 1977

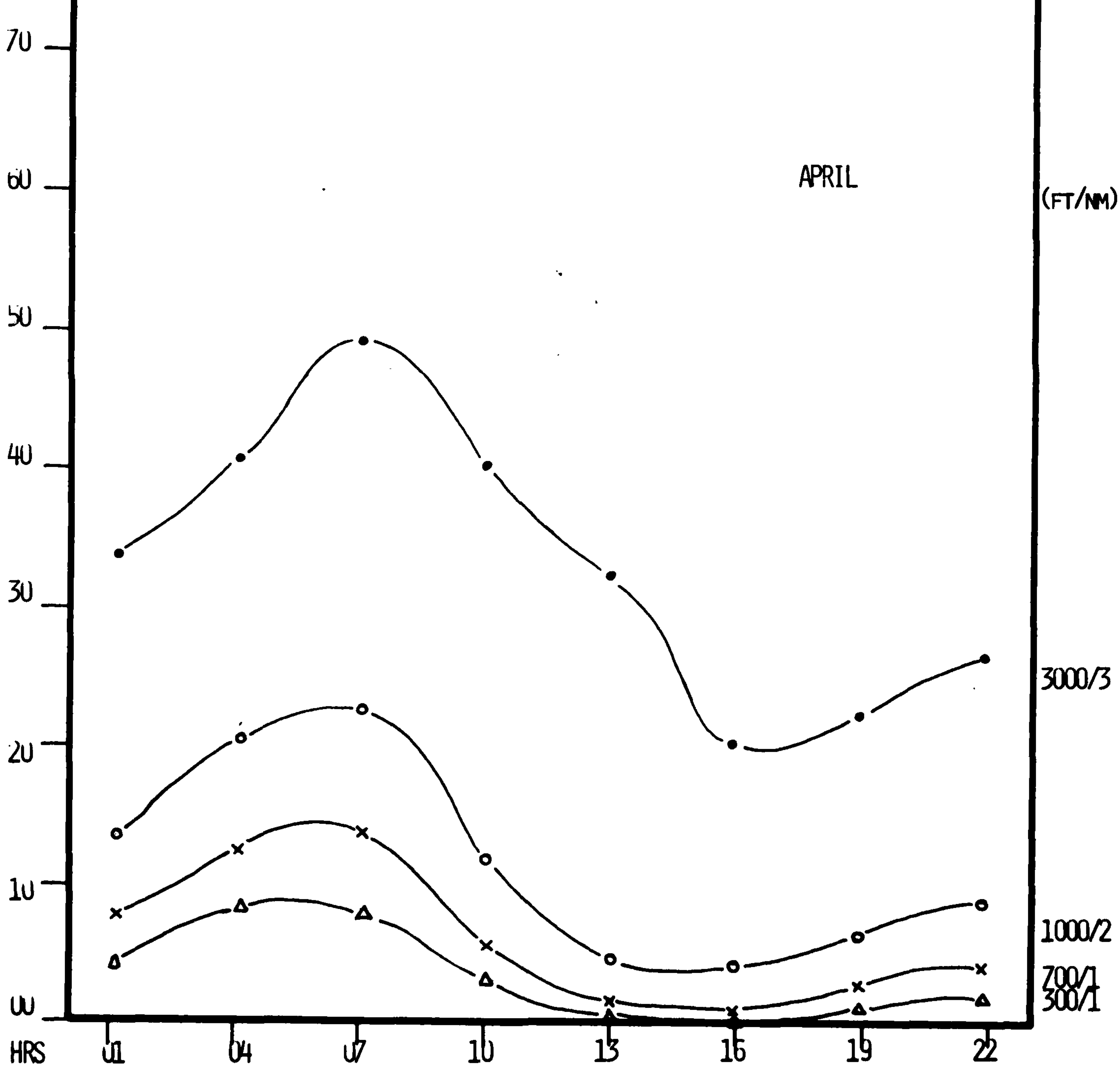

FIGURE 2-5

% FREQUENCY OF OCCURRENCE OF CIG AND/OR VIS LESS THAN THE INDICATED CATEGORIES IN MAY BY HOUR (GMT).

LOCATION: RAF ALCONBURY

SOURCE: RUSSWO, 30 NOV 1977

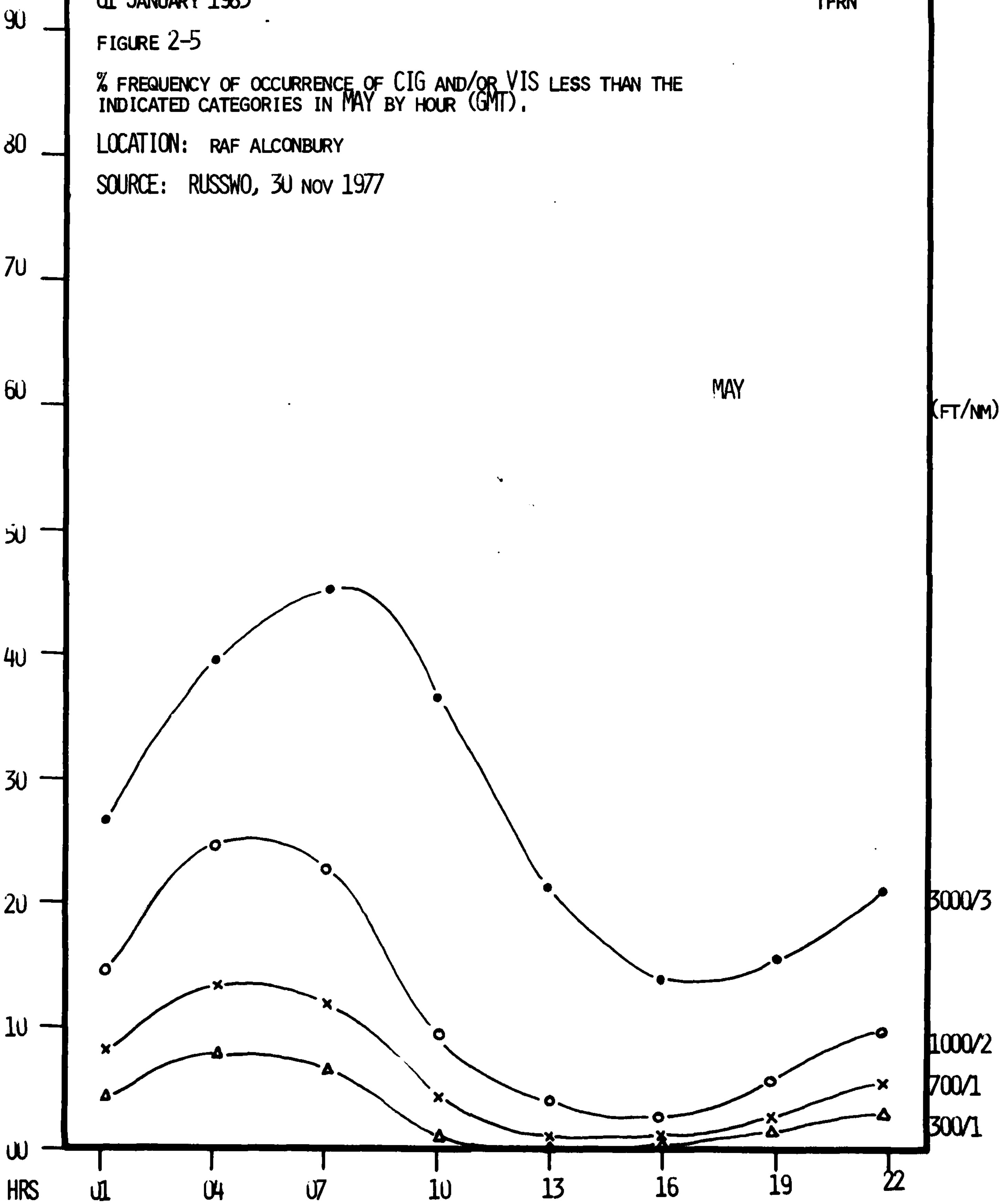

FIGURE 2-6

% FREQUENCY OF OCCURRENCE OF CIG AND/OR VIS LESS THAN THE INDICATED CATEGORIES IN JUNE BY HOUR (GMT).

LOCATION: RAF ALCONBURY

SOURCE: RUSSWO, 30 NOV 1977

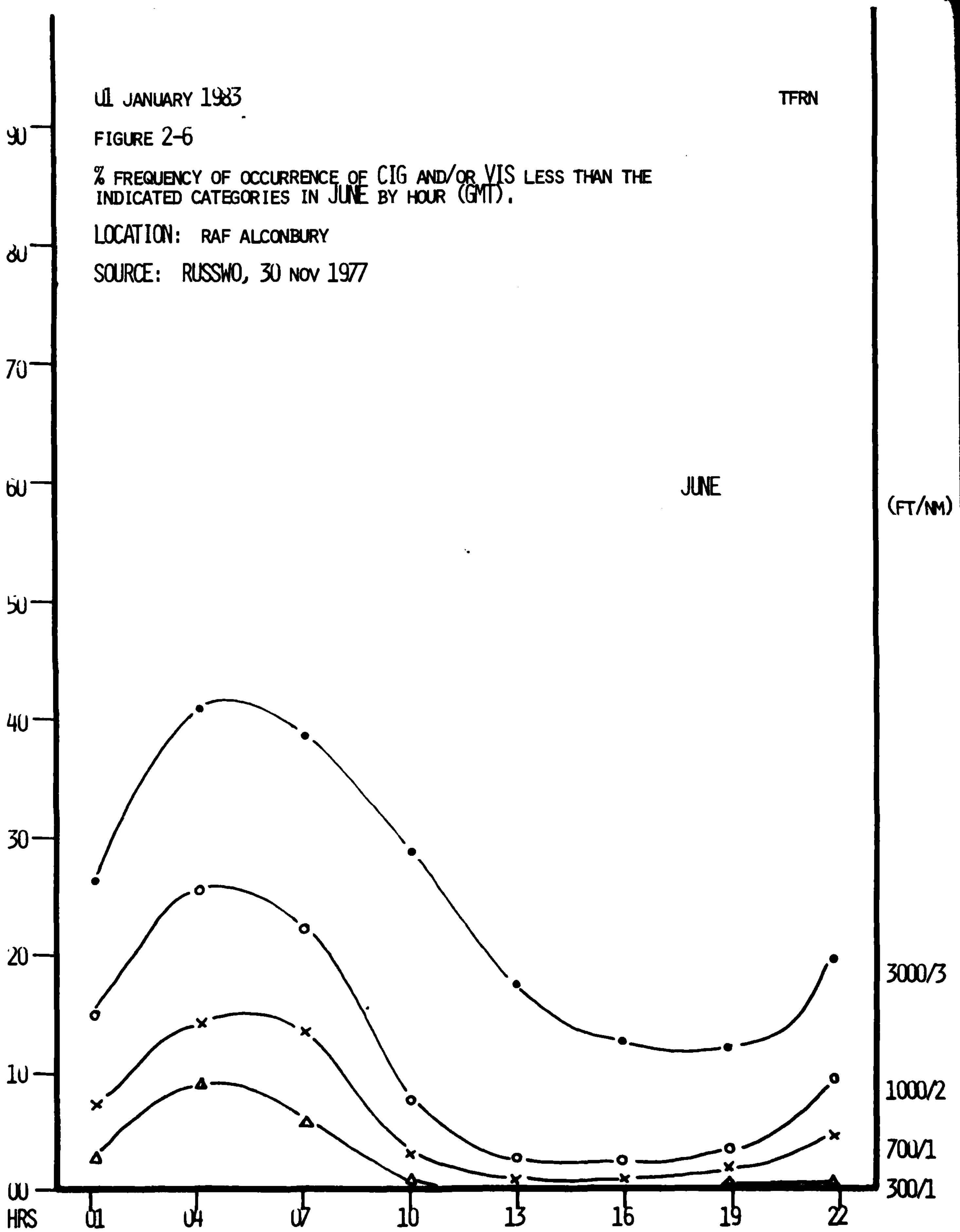

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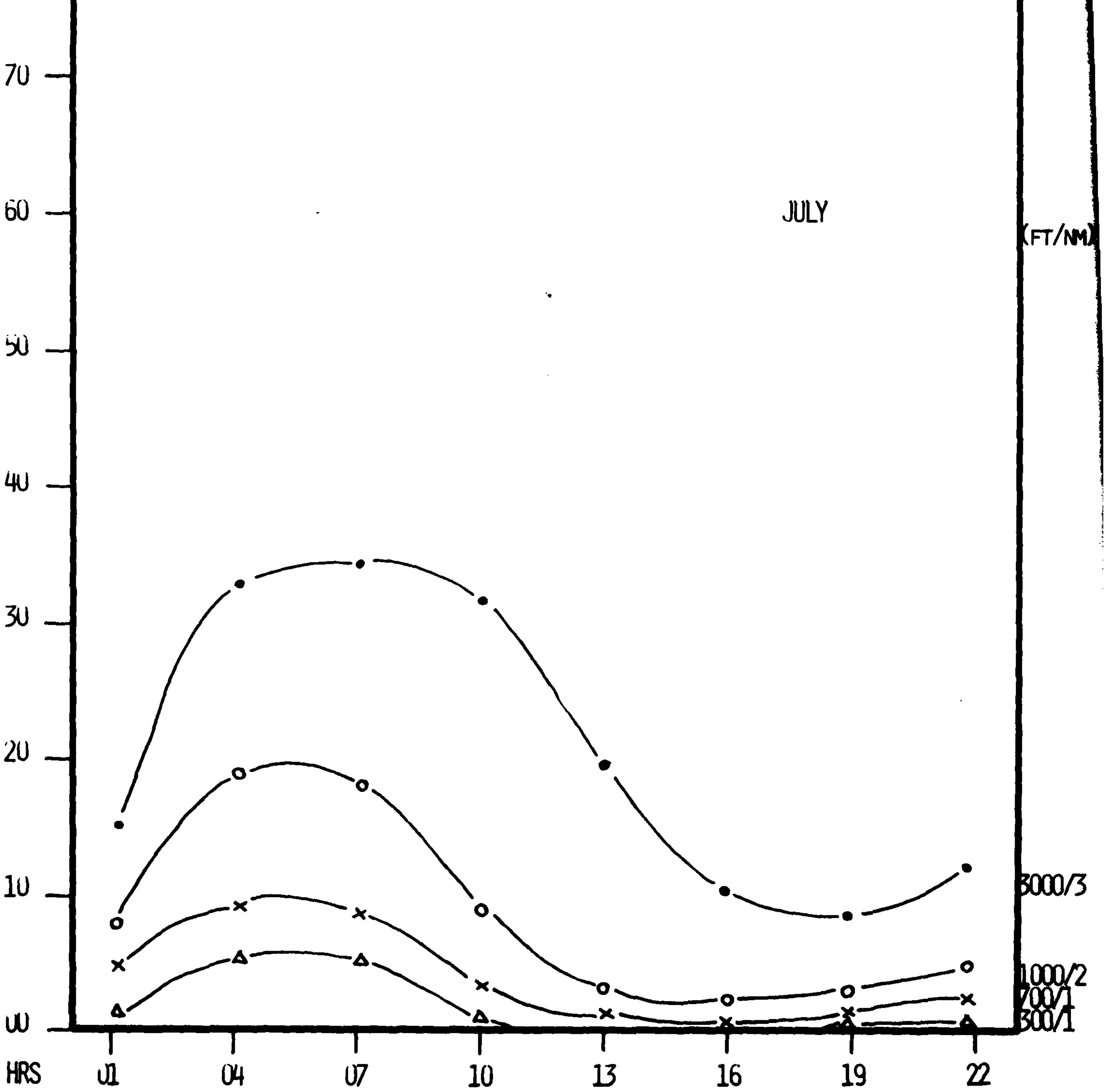
FIGURE 2-7

% FREQUENCY OF OCCURRENCE OF CIG AND/OR VIS LESS THAN THE INDICATED CATEGORIES IN JULY BY HOUR (GMT).

LOCATION: RAF ALCONBURY

SOURCE: RUSSWO, 30 NOV 1977



01 JANUARY 1983

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FIGURE 2-8

% FREQUENCY OF OCCURRENCE OF CIG AND/OR VIS LESS THAN THE INDICATED CATEGORIES IN AUGUST BY HOUR (GMT).

LOCATION: RAF ALCONBURY

SOURCE: RUSSWO, 30 NOV 1977

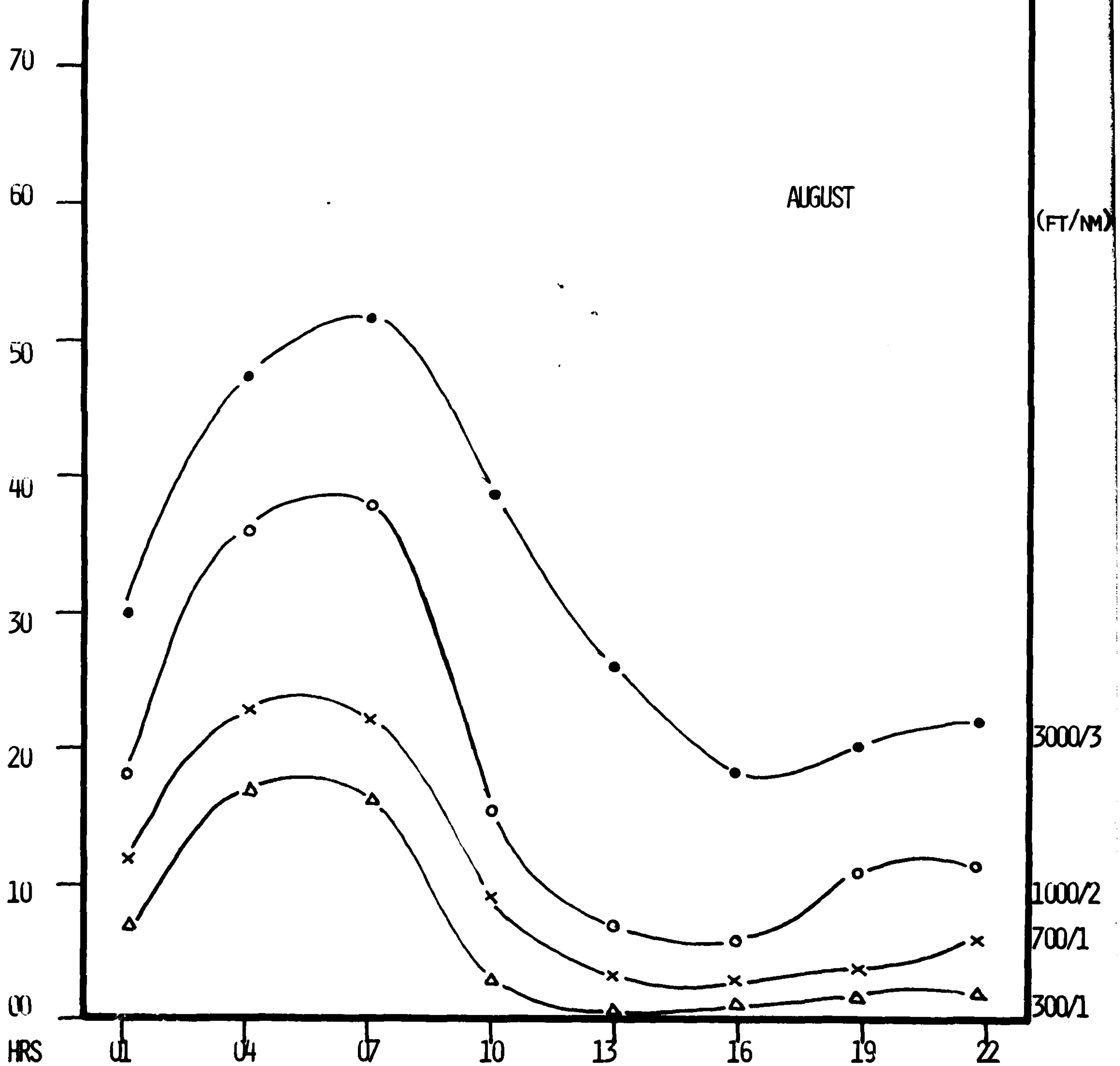

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FIGURE 2-9

% FREQUENCY OF OCCURRENCE OF CIG AND/OR VIS LESS THAN THE INDICATED CATEGORIES IN SEPTEMBER BY HOUR (GMT).

LOCATION: RAF ALCONBURY

SOURCE: RUSSWO, 30 NOV 1977

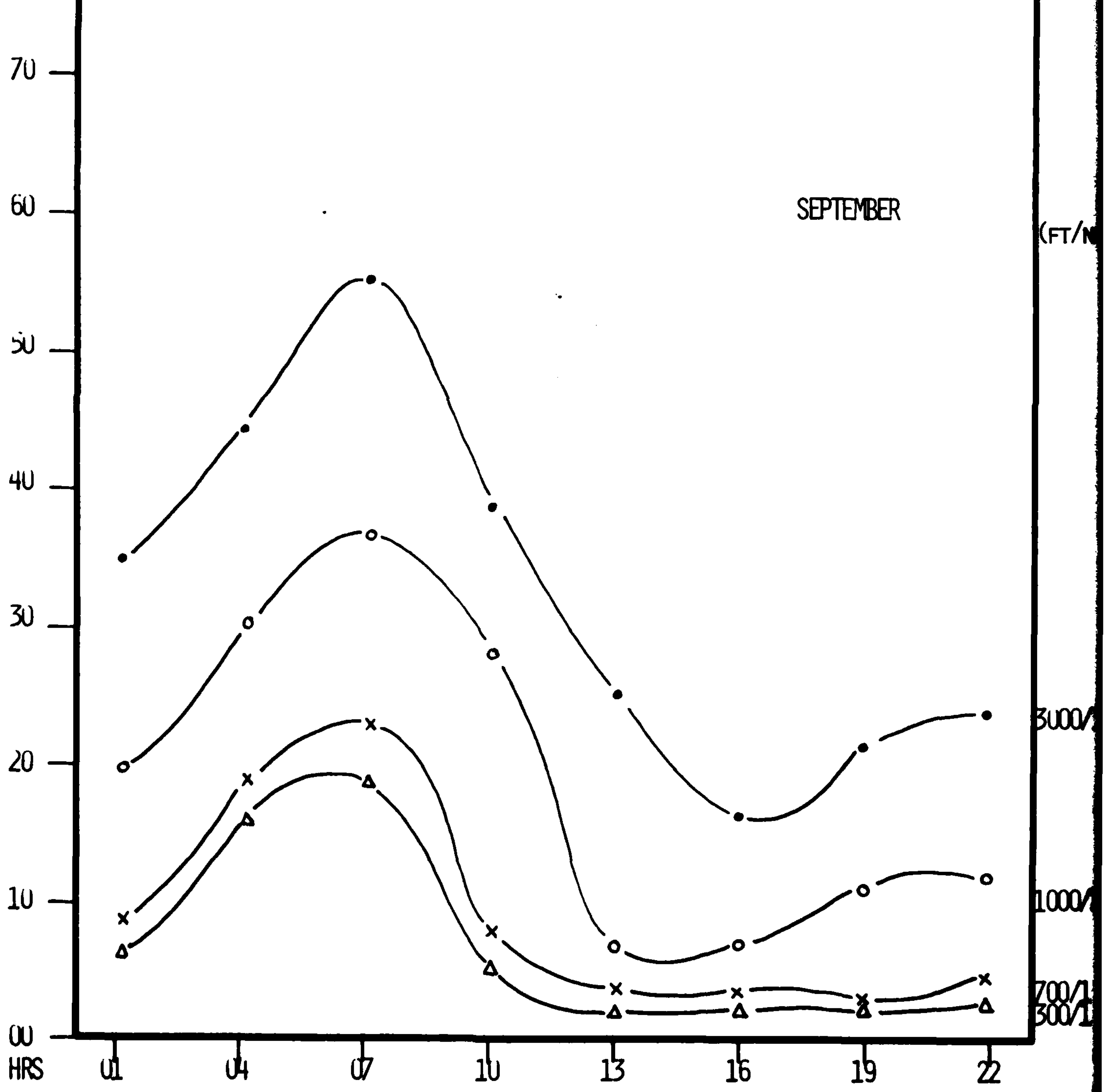

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FIGURE 2-10

% FREQUENCY OF OCCURRENCE OF CIG AND/OR VIS LESS THAN THE INDICATED CATEGORIES IN OCTOBER BY HOUR (GMT).

LOCATION: RAF ALCONBURY

SOURCE: RUSSWO, 30 NOV 1977

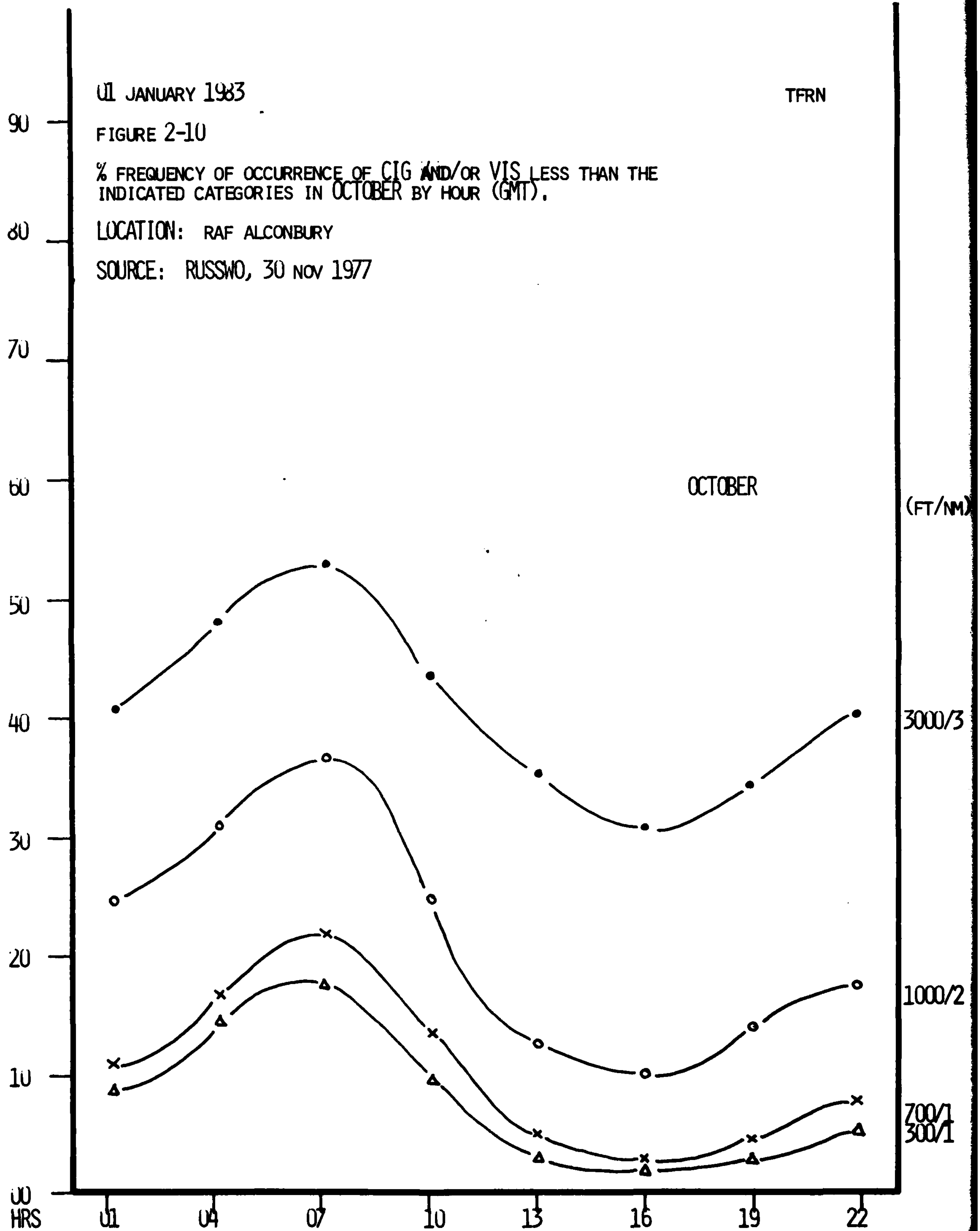

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FIGURE 2-11

% FREQUENCY OF OCCURRENCE OF CIG AND/OR VIS LESS THAN THE INDICATED CATEGORIES IN NOVEMBER BY HOUR (GMT).

LOCATION: RAF ALCONBURY

SOURCE: RUSSWO, 30 NOV 1977

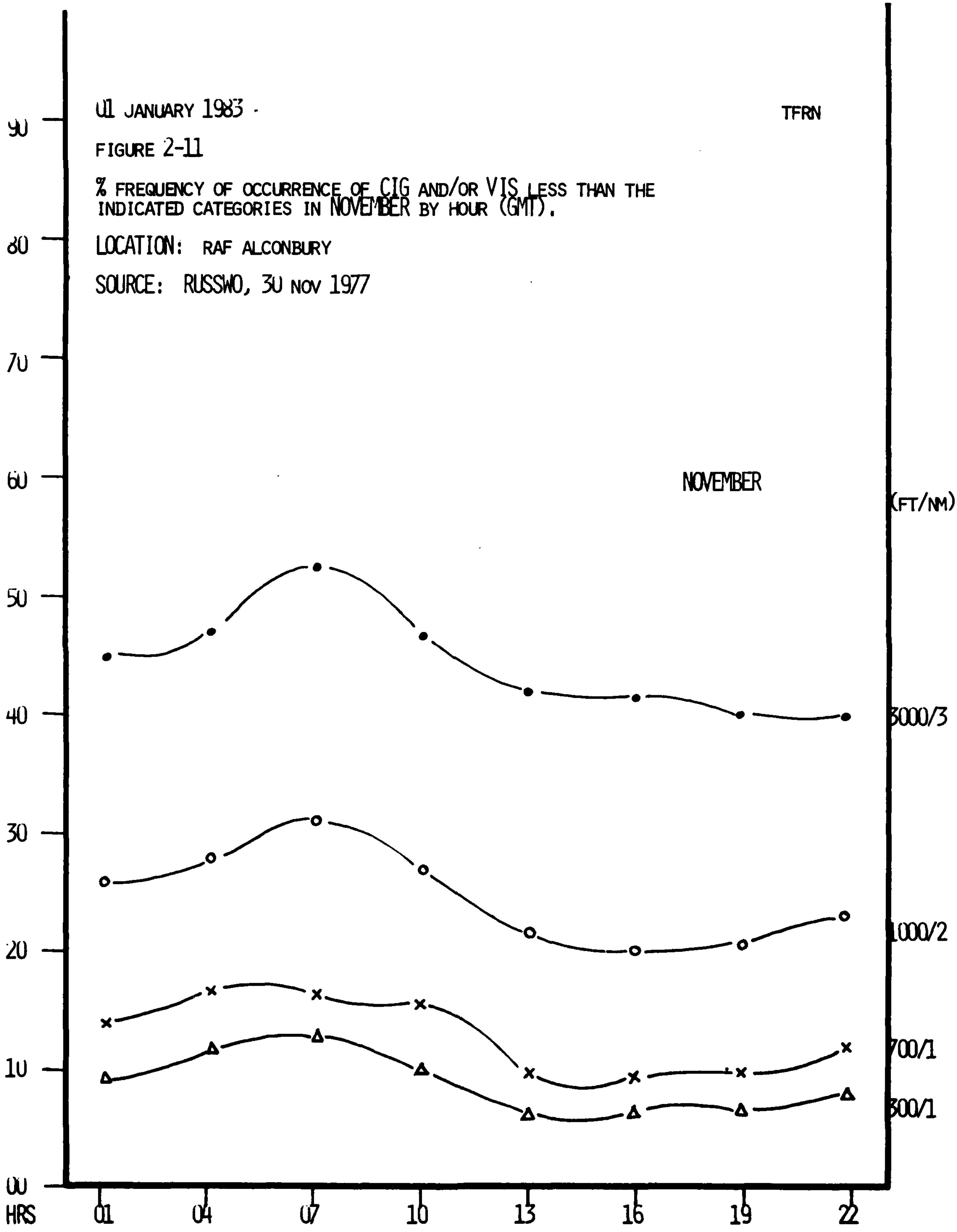

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FIGURE 2-12

% FREQUENCY OF OCCURRENCE OF CIG AND/OR VIS LESS THAN THE INDICATED CATEGORIES IN DECEMBER BY HOUR (GMT).

LOCATION: RAF ALCONBURY

SOURCE: RUSSWO, 30 NOV 1977

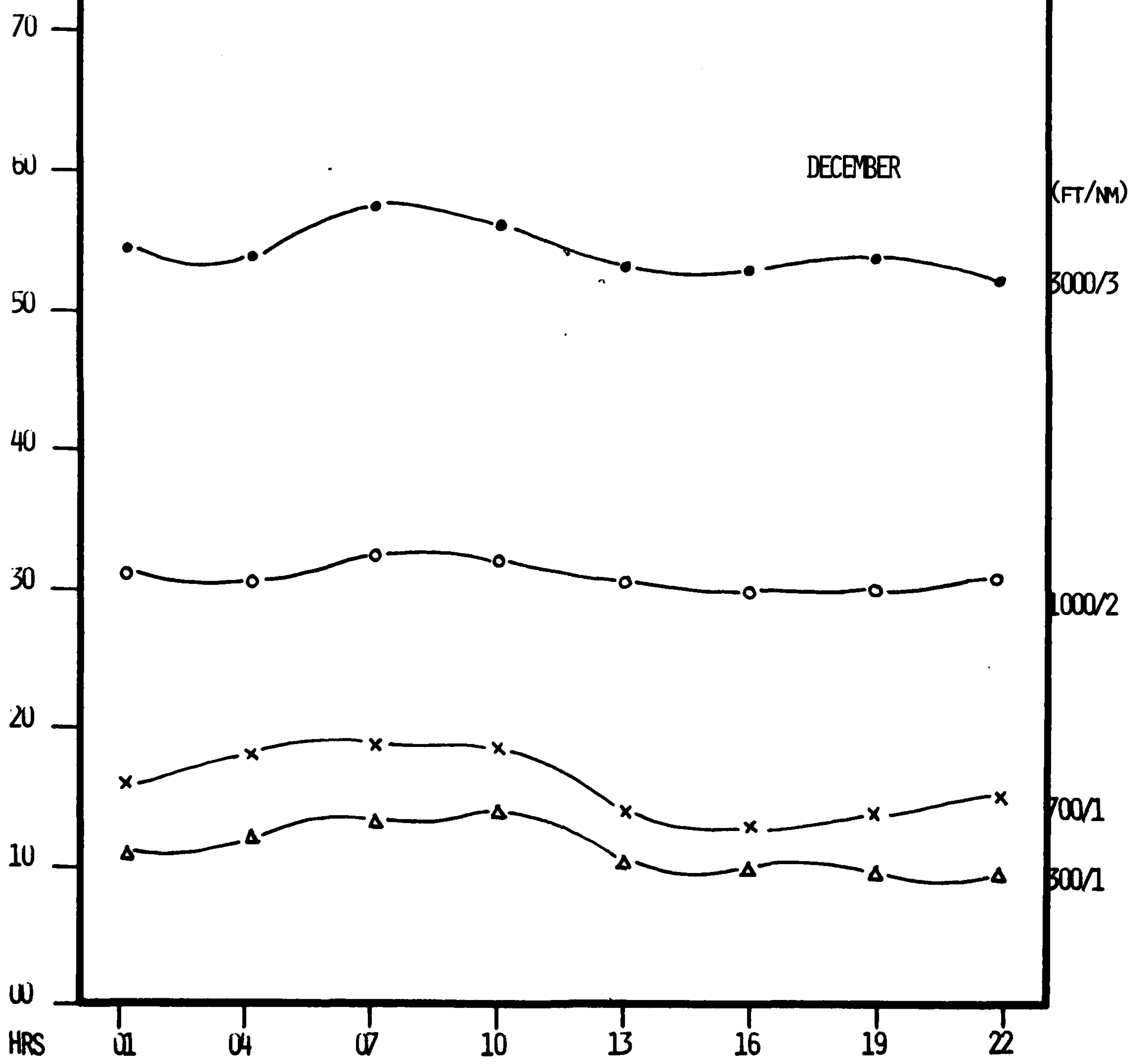

FIGURE 2-13. January Wind Rose, all weather, all hours (% frequency of occurrence for 16 compass points).

LOCATION: RAF Alconbury

SOURCE: RUSSWO, 30 Nov 77 and daily climatology logs for Jan 1973 to Dec 1982. (Peak gusts)

Extreme peak gust: 65 knots.
Winds calm: 4.9%
( ) Extremes for various directions GT 34KTS.

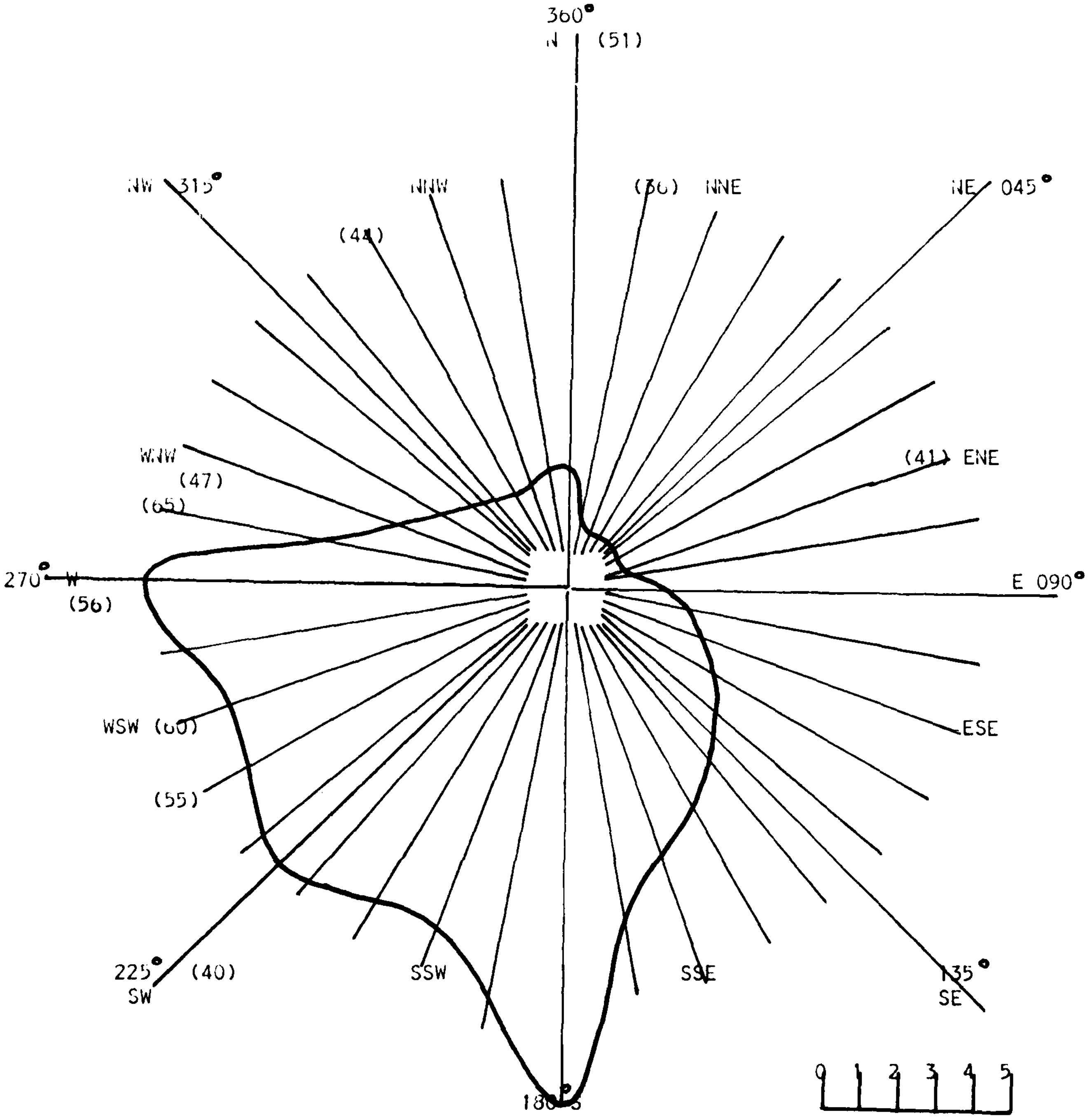

FIGURE 2-15. March Wind Rose, all weather, all hours (% frequency of occurrence for 16 compass points).

LOCATION: RAF Alconbury

SOURCE: RUSSWO, 30 Nov 77 and daily climatology logs for Jan 1978 to Dec 1982. (Peak Gusts)

Extreme peak gust: 50 knots
Winds calm: 5.3%
( ) Extremes for various directions GT 34KTS.

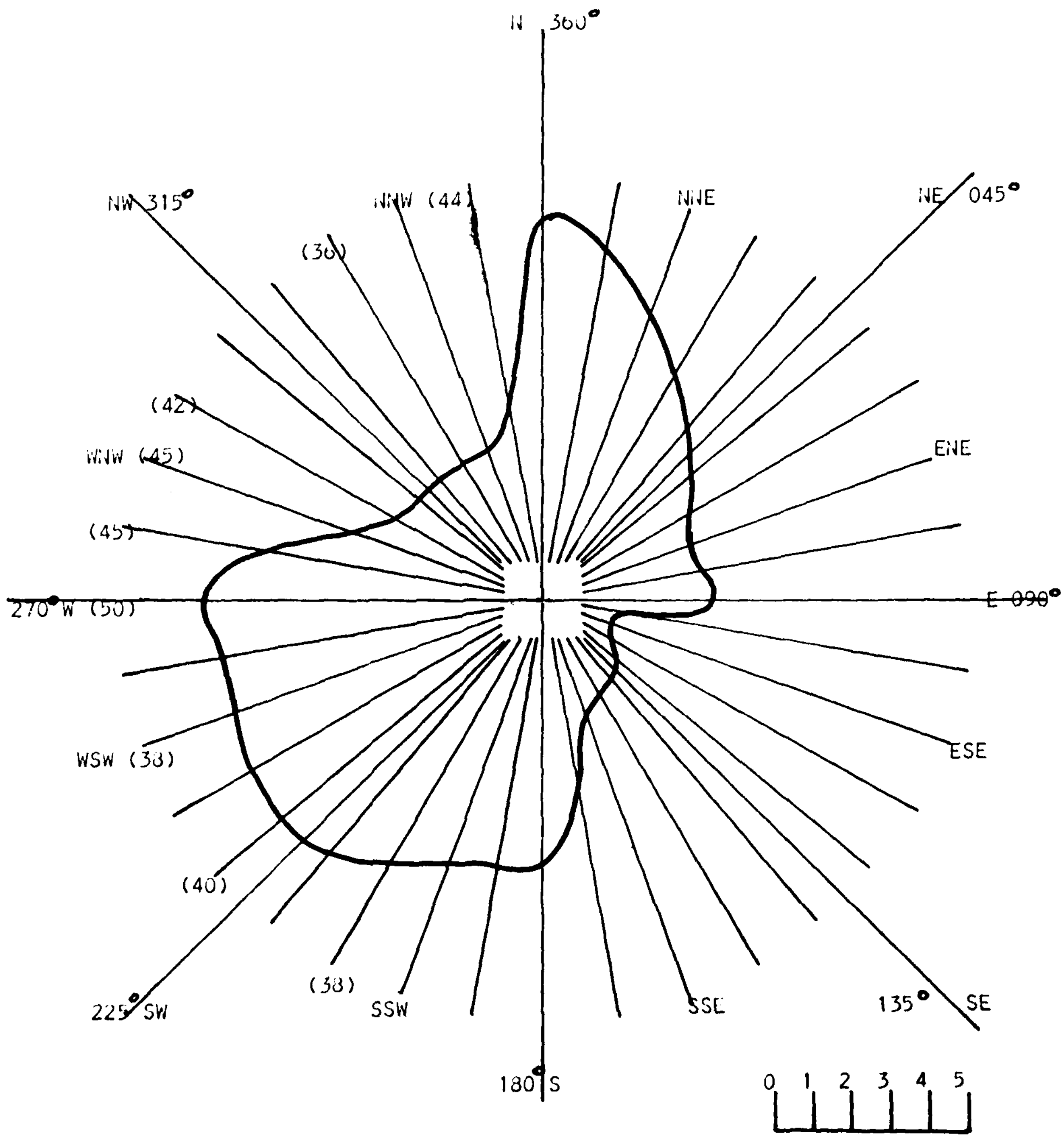

FIGURE 2-14. February Wind Rose, all weather, all hours (% frequency of occurrence for 16 compass points).

LOCATION: RAF Alconbury

SOURCE: RUSSWO, 30 Nov 77 and daily climatology logs for Jan 1978 to Dec 1982. (Peak gusts)

Extreme peak gust: 52 knots
Winds calm: 5.7%
( ) Extremes for various directions GT 34KTS.

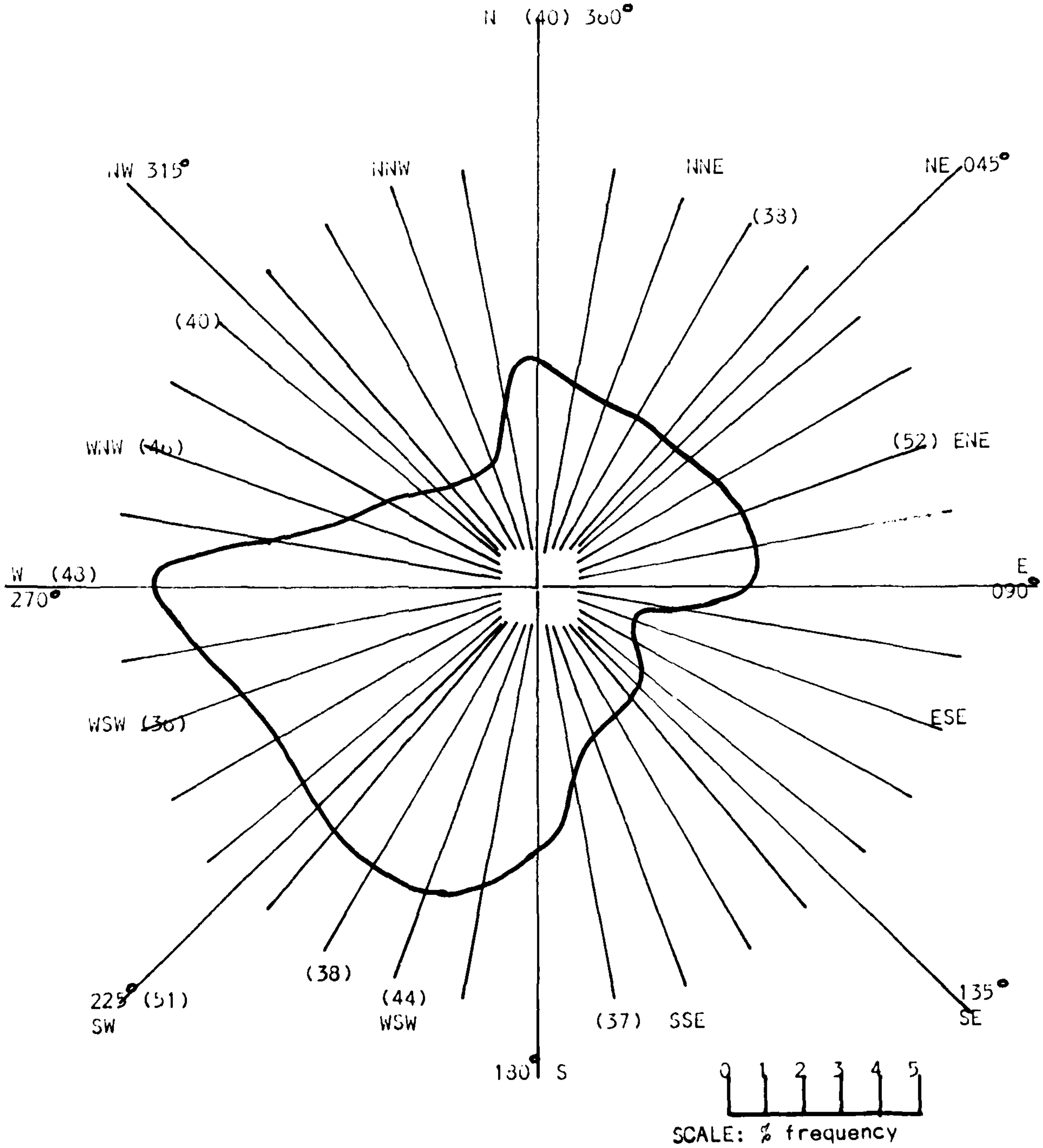

FIGURE 2-16. April Wind Rose, all weather, all hours (% frequency of occurrence for 16 compass points).

LOCATION: RAF Alconbury

SOURCE: RUSSWO, 30 Nov 77 and daily climatology logs for Jan 1973 to Dec 1982. (Peak Gusts)

Extreme peak gust: 48 knots
Winds calm: 5.6%
( ) Extremes for various directions GT 34KTS

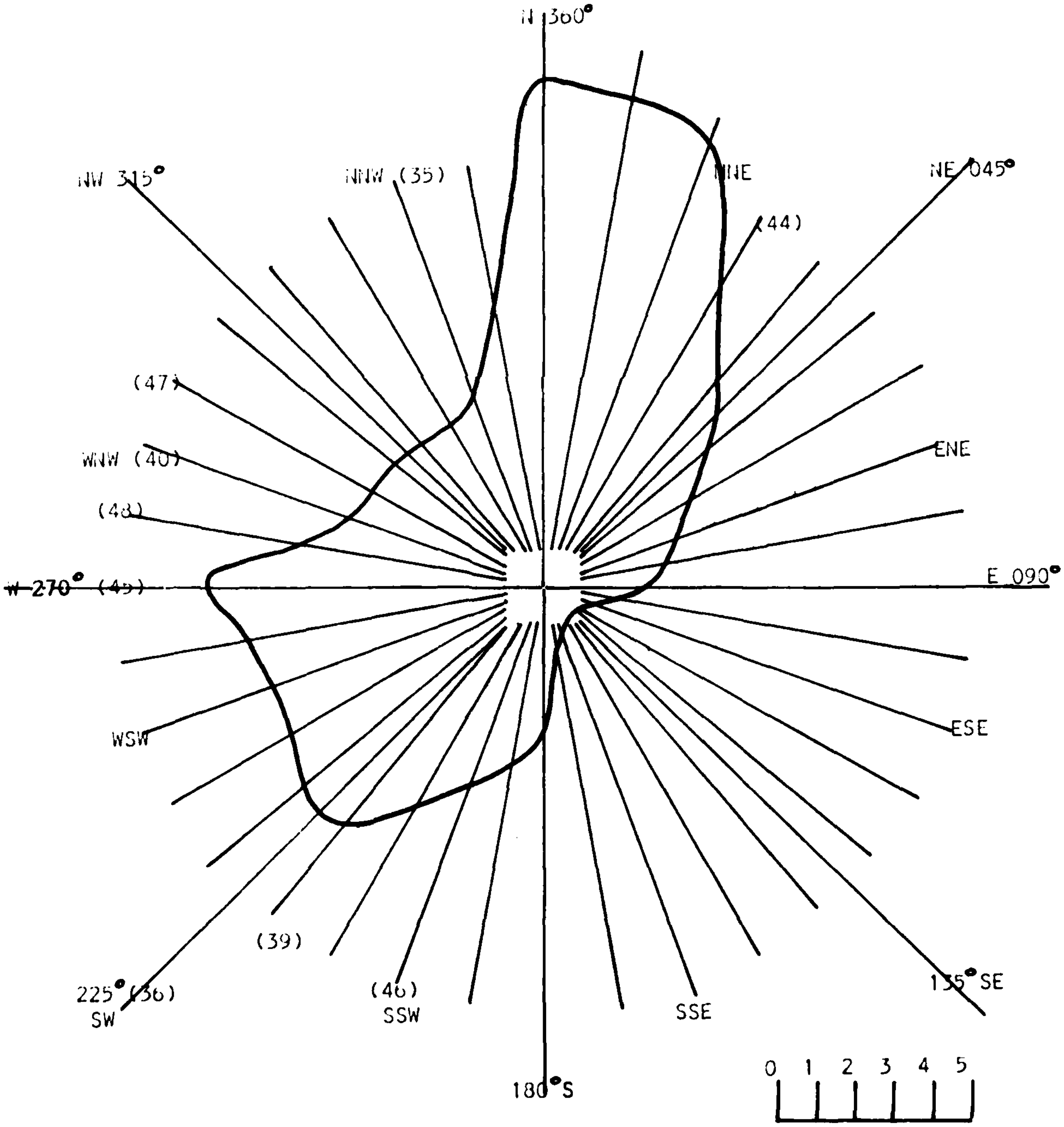

FIGURE 2-17. May Wind Rose, all weather, all hours (% frequency of occurrence for 16 compass points).

LOCATION: RAF Alconbury

SOURCE: RUSSWO, 30 Nov 77 and daily climatology logs for Jan 1978 to Dec 1982. (Peak Gusts)

Extreme peak gust: 42 knots
Winds calm: 6.9%
( ) Extremes for various directions GT 34KTS

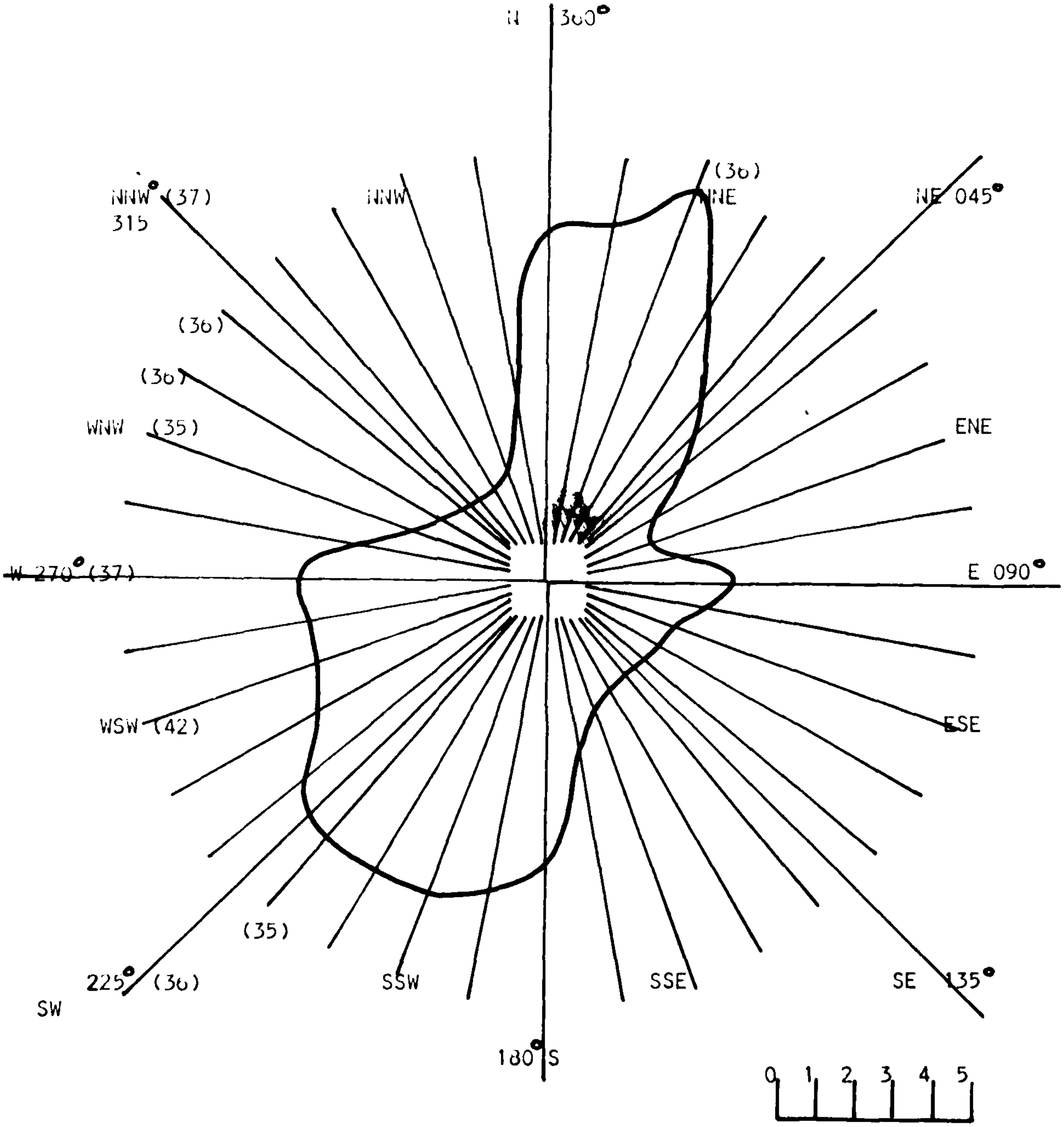

FIGURE 2-18. June Wind Rose, all weather. all hours (% frequency of occurrence for 16 compass points).

LOCATION: RAF Alconbury

SOURCE: RUSSWO, 30 Nov 77 and daily climatology logs for Jan 1978 to Dec 1982. (Peak Gusts)

Extreme Peak Gust: 41 knots
Winds calm: 7.8%
( ) Extremes for various directions GT 34KTS

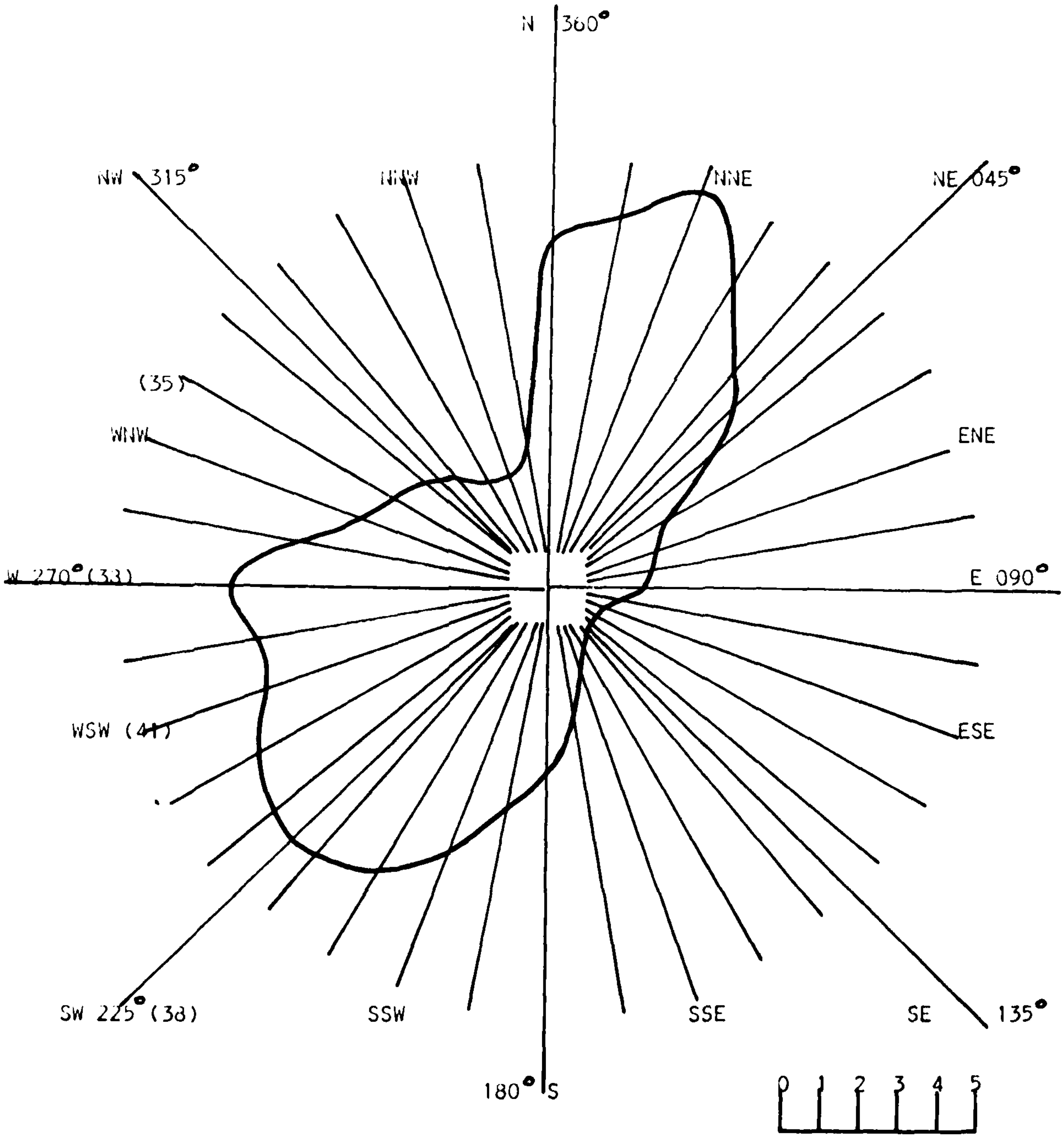

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FIGURE 2-19. July Wind Rose, all weather, all hours (% frequency of occurrence for 16 compass points).

LOCATION: RAF Alconbury

SOURCE: RUSSWO, 30 Nov 77 and daily climatology logs for Jan 1978 to Dec 1982. (Peak Gusts)

Extreme Peak Gust: 51 knots
Winds Calm: 9.1%
( ) Extremes for various directions GT 34KTS

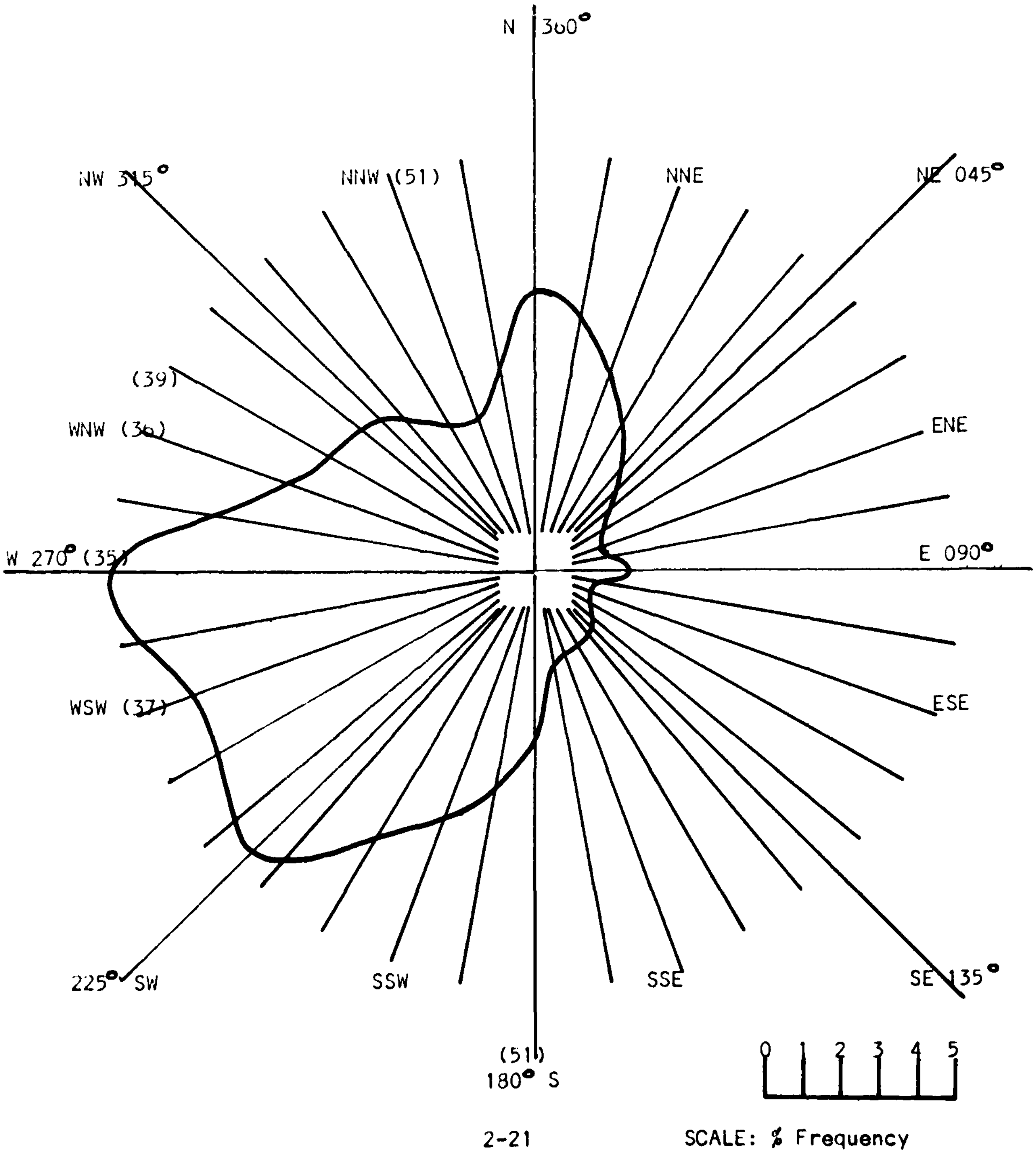


FIGURE 2-20. August Wind Rose, all weather, all hours (% frequency of occurrence for 16 compass points).

LOCATION: RAF Alconbury

SOURCE: RUSSWO, 30 Nov 77 and daily climatology logs for Jan 1978 to Dec 1982. Peak Gusts)

Extreme Peak Gust: 43 knots
Winds Calm: 9.4%
( ) Extremes for various directions GT 34KTS

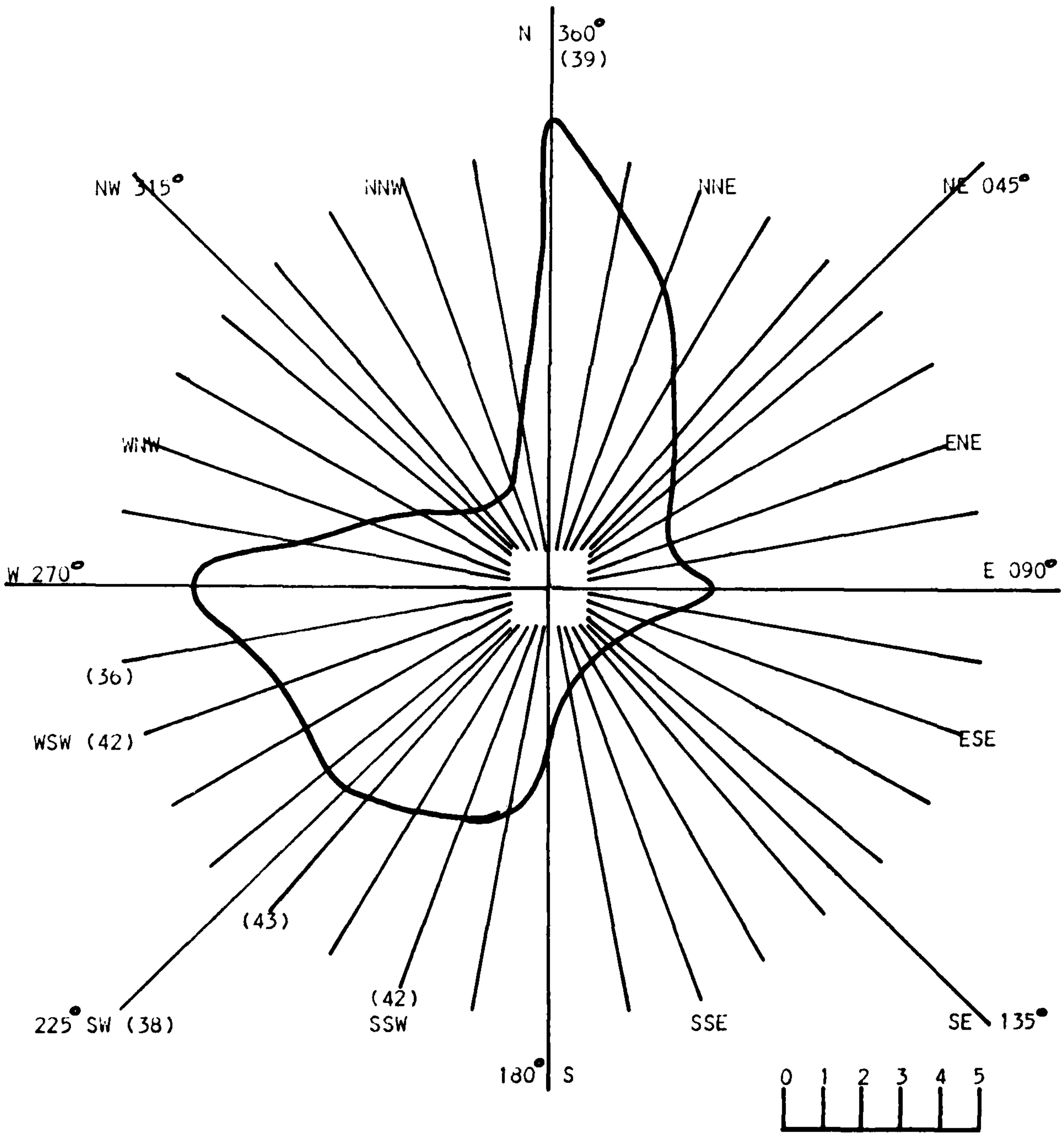


FIGURE 2-21. September Wind Rose, all weather, all hours (% frequency of occurrence for 16 compass points).

LOCATION: RAF Alconbury

SOURCE: RUSSWO, 30 Nov 77 and daily climatology logs for Jan 1978 to Dec 1982. (Peak Gusts)

Extreme Peak Gust: 50 knots
Winds Calm: 8.4%
( ) Extremes for various directions GT 34KTS

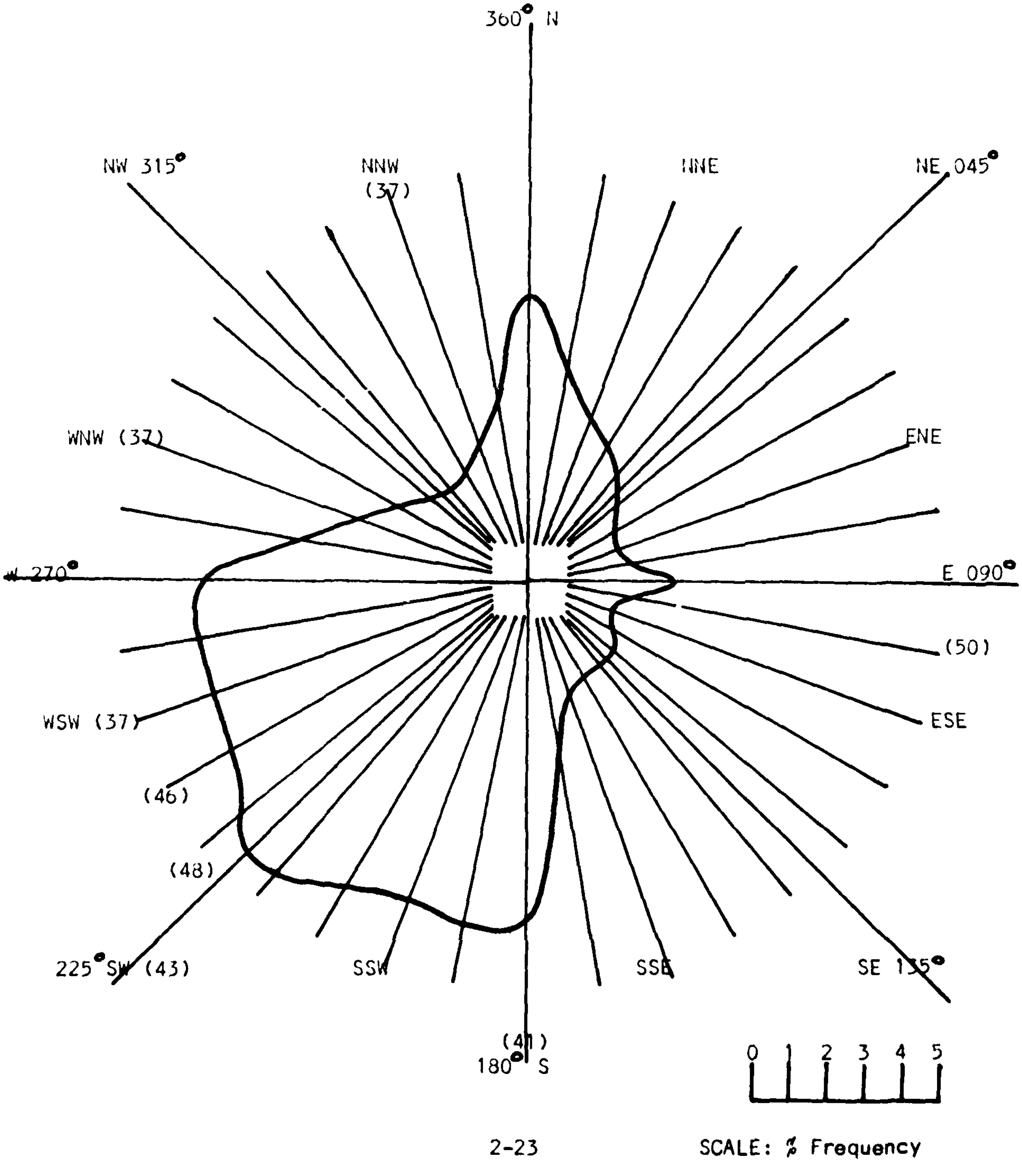
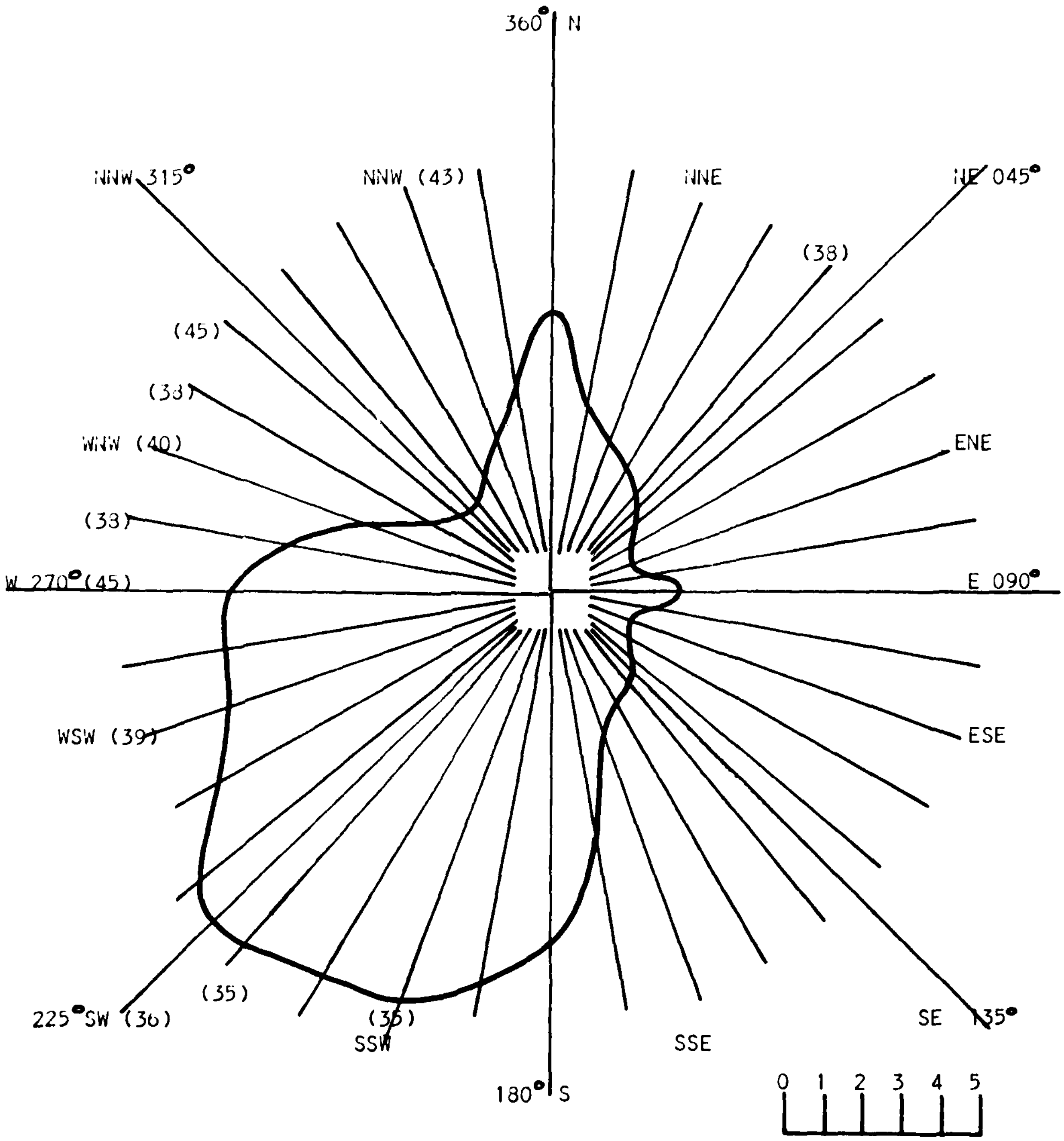


FIGURE 2-22. October Wind Rose, all weather, all hours (% frequency of occurrence for 16 compass points).

LOCATION: RAF Alconbury

SOURCE: RUSSWO, 30 Nov 77 and daily climatology logs for Jan 1978 to Dec 1982. (Peak Gusts)

Extreme Peak Gust: 45 knots
Winds Calm: 7.1%
( ) Extremes for various directions GT 34KTS



SCALE: % Frequency

FIGURE 2-23. November Wind Rose, all weather, all hours (% frequency of occurrence for 16 compass points).

LOCATION: RAF Alconbury

SOURCE: RUSSWO, 30 Nov 77 and daily climatology logs for Jan 1978 to Dec 1982. (Peak Gusts)

Extreme Peak Gust: 54 knots
Winds Calm: 4.7%
( ) Extremes for various directions GT 34KTS

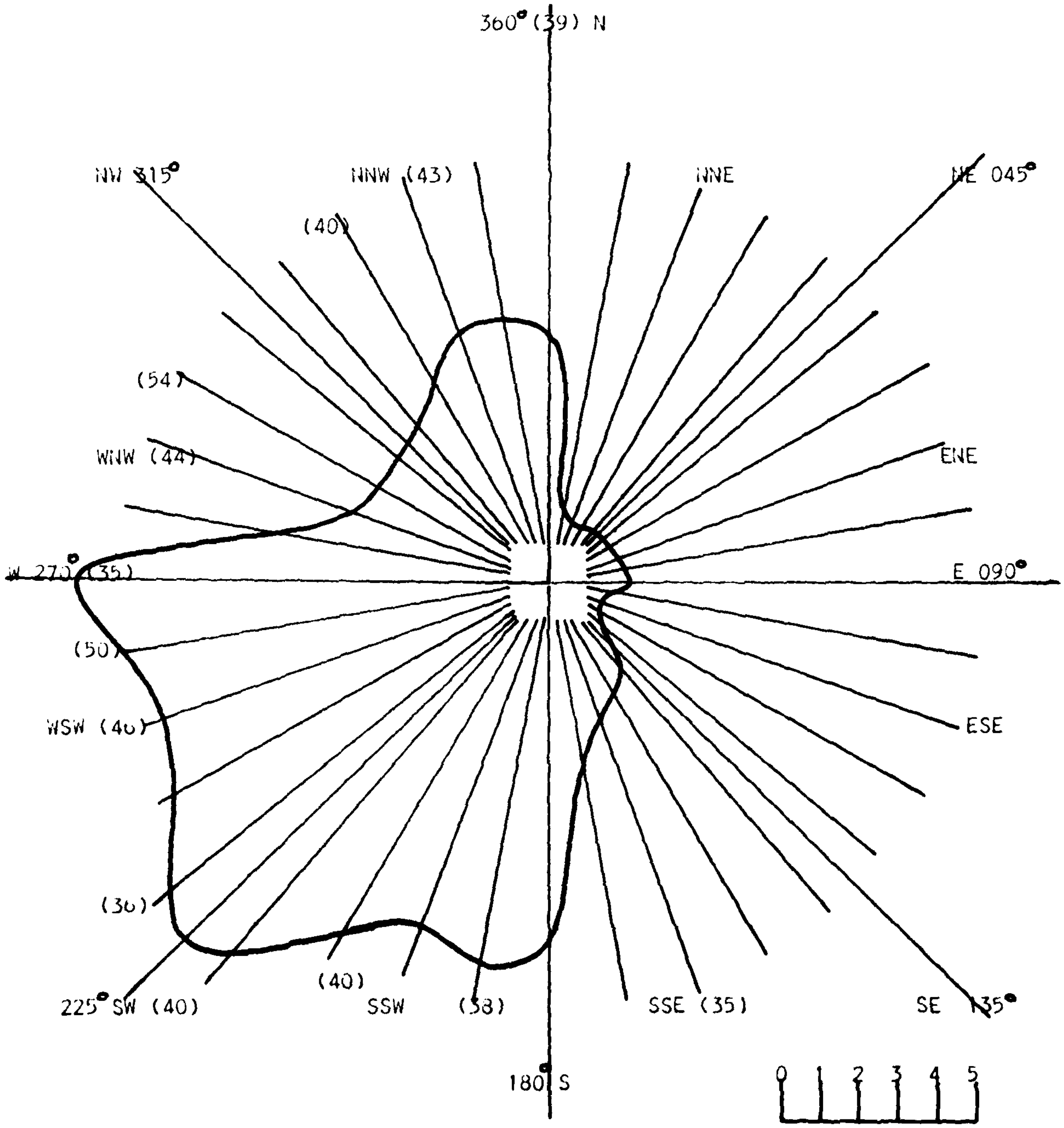
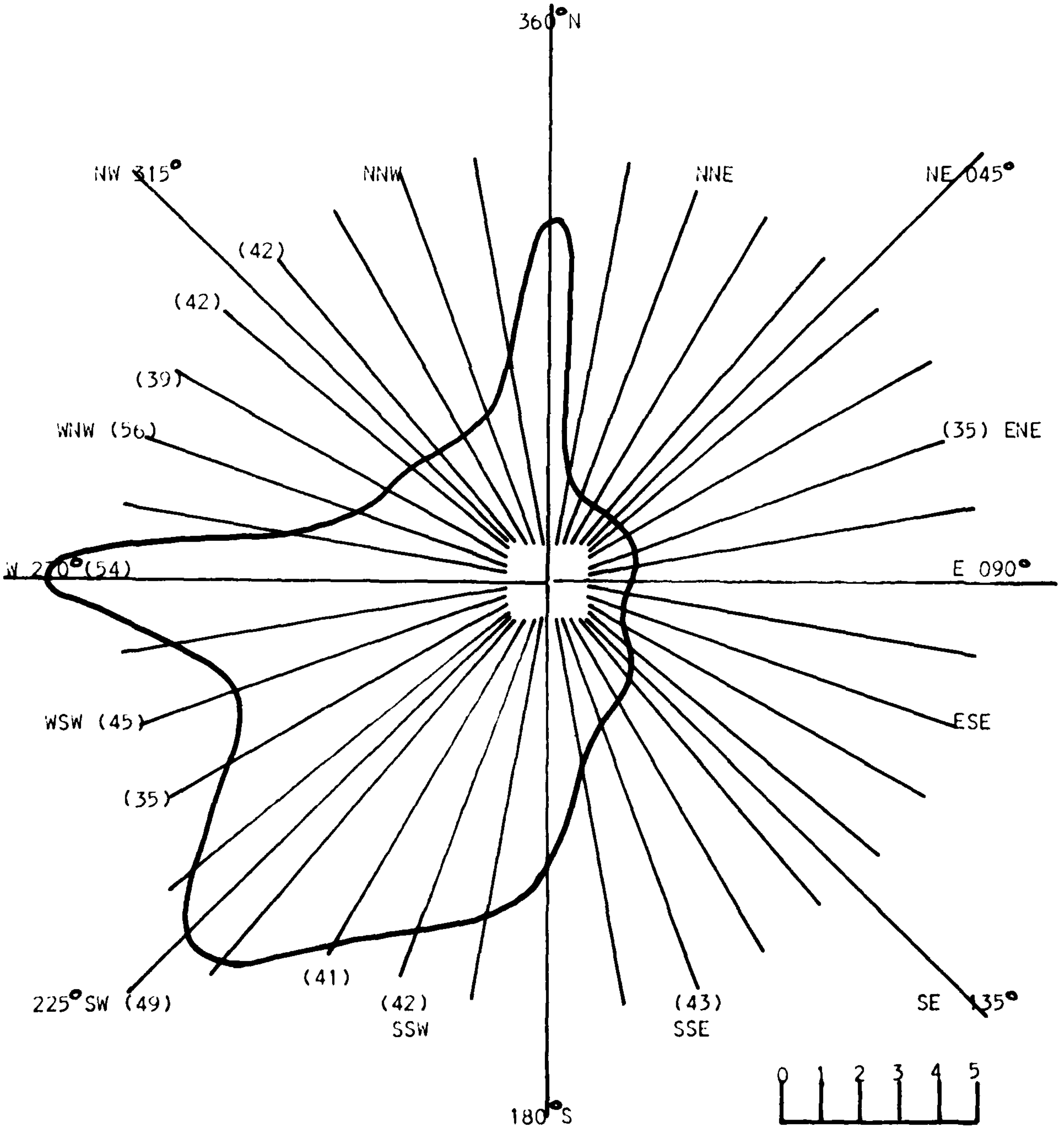


FIGURE 2-24. December Wind Rose, all weather, all hours (% frequency of occurrence for 16 compass points).

LOCATION: RAF Alconbury

SOURCE: RUSSWO, 30 Nov 77 and daily climatology logs for Jan 1978 to Dec 1982. (Peak Gusts)

Extreme Peak Gust: 56 knots
Winds Calm: 4.8%
( ) Extremes for various directions GT 34KTS



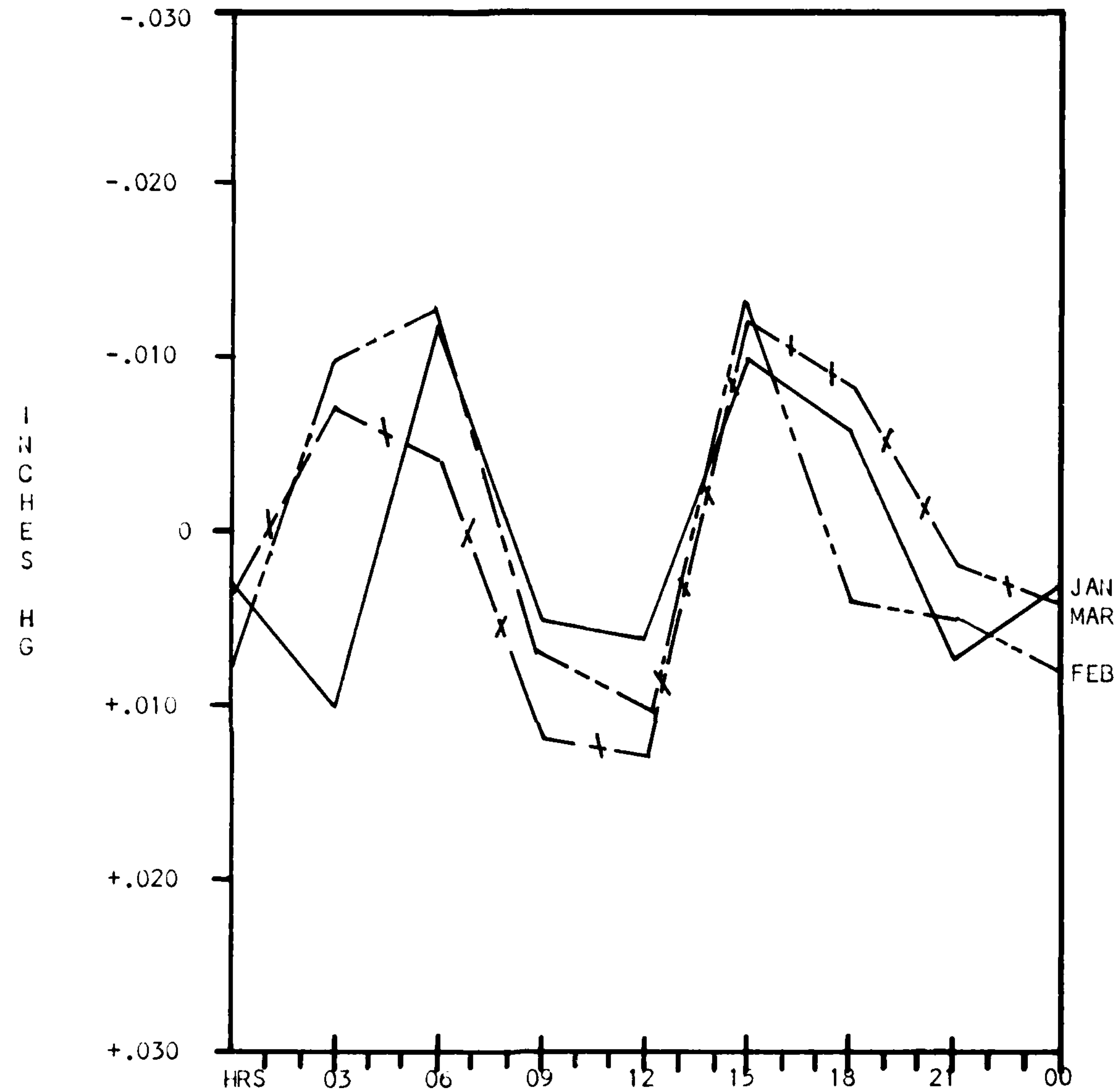


FIGURE 2-25.

Deviation from mean station pressure by hour (GMT) for: Jan ———— 29.696*
Feb – - – - – 29.714*
Mar —+—+— 29.786*

LOCATION: RAF Alconbury
SOURCE: RUSSWO, 30 Nov 77

* Mean Station Pressure

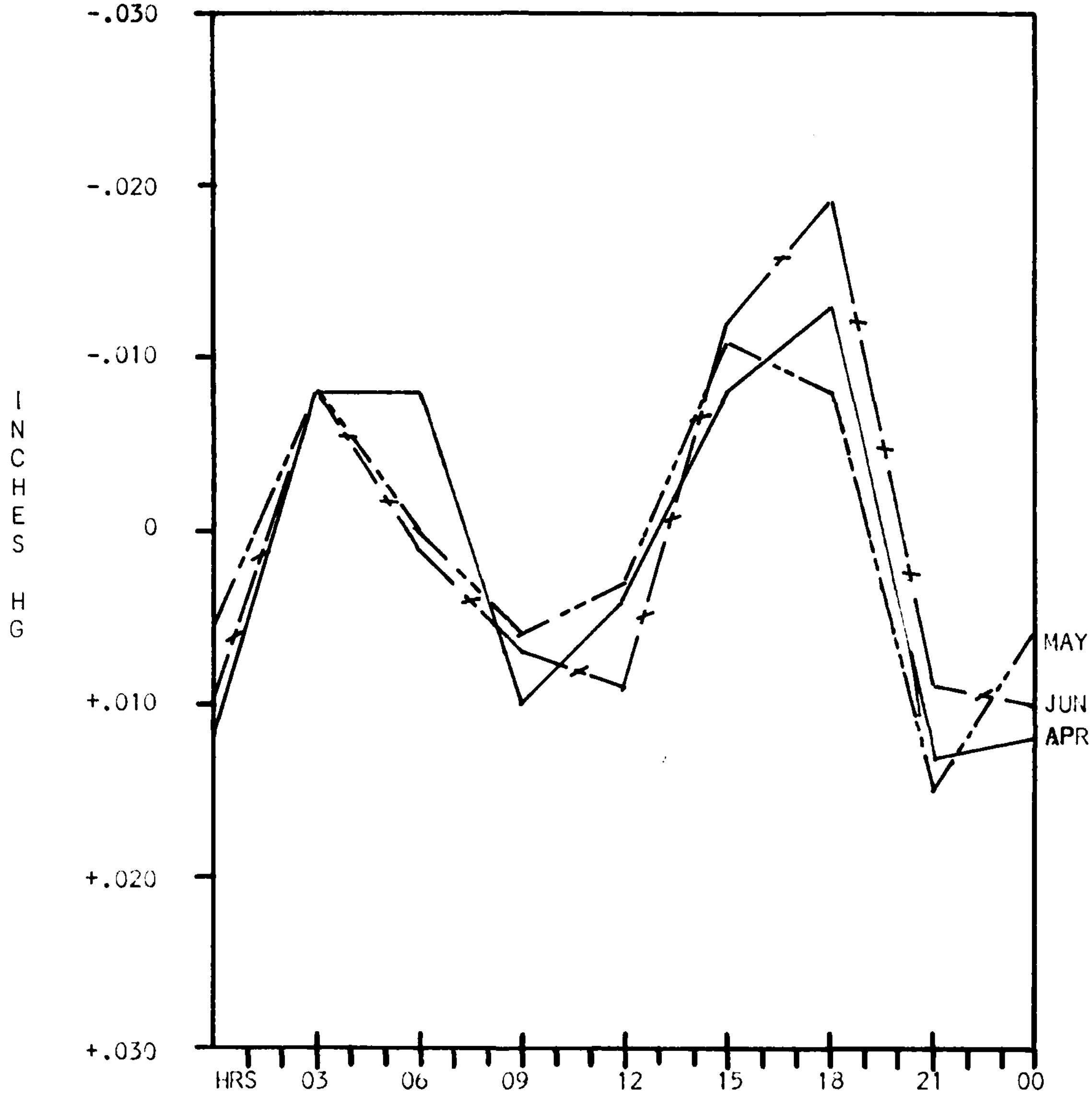


FIGURE 2-26
Deviation from mean station pressure by hour (GMT) for: Apr —— 29.797*
May -·-·— 29.751*
Jun — — — 29.852*

LOCATION: RAF Alconbury
SOURCE: RUSSWO, 30 Nov 77

* Mean Station Pressure

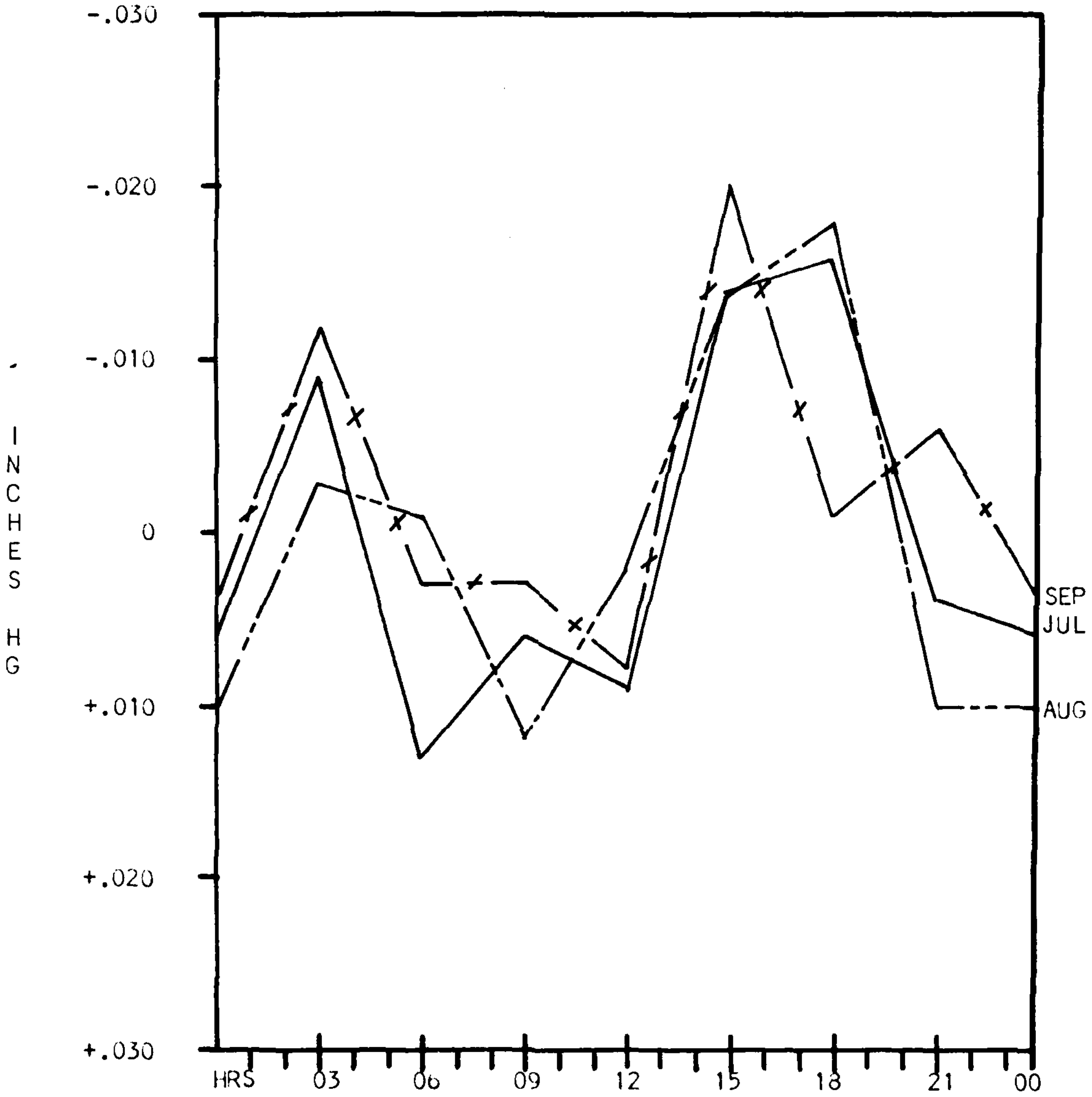


FIGURE 2-27
Deviation from mean station pressure by hour (GMT) for: Jul 29.846*
Aug 29.817*
Sep 29.761*

LOCATION: RAF Alconbury
SOURCE: RUSSWO, 30 Nov 77

*Mean Station Pressure

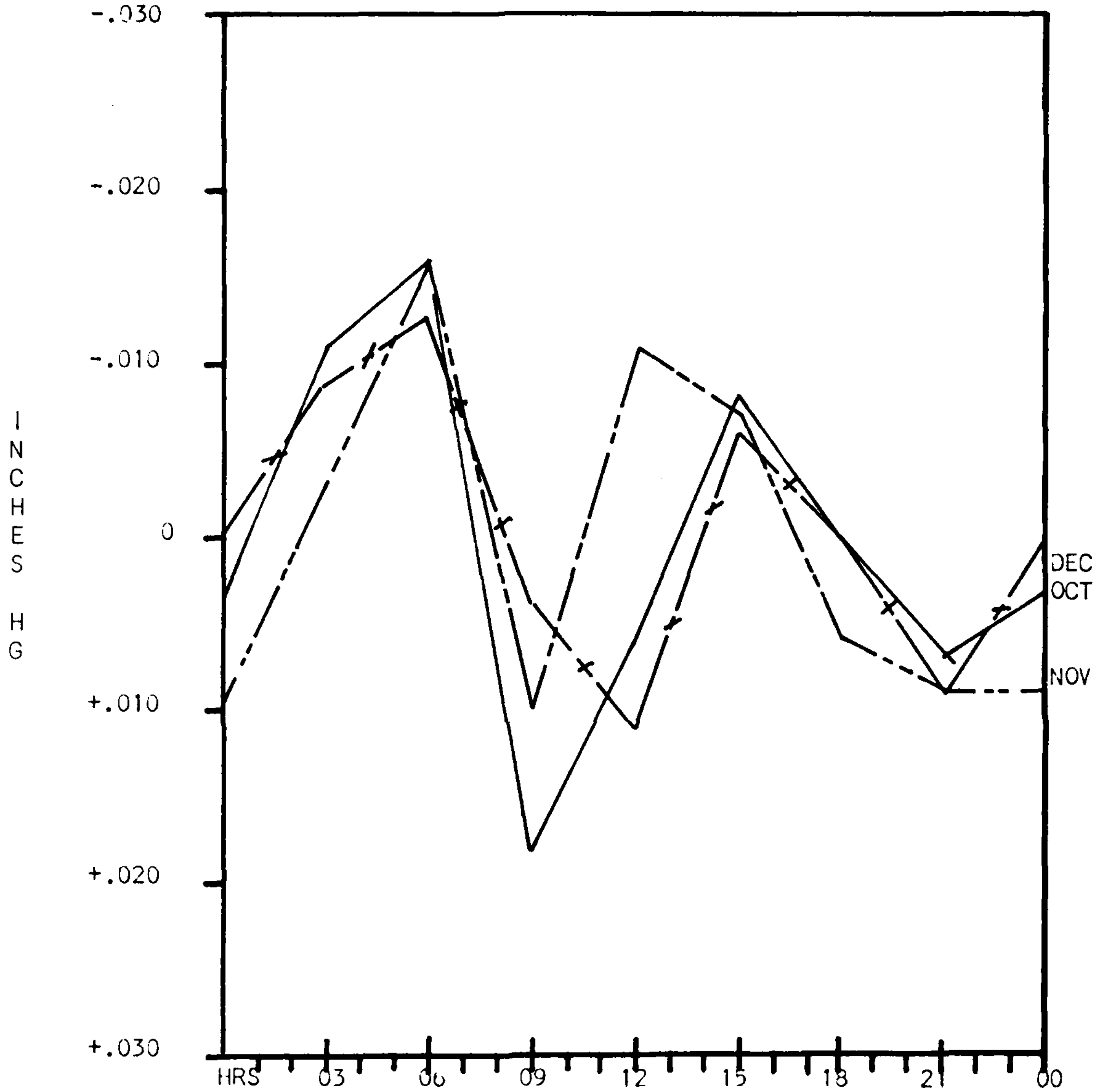


FIGURE 2-28
Deviation from mean station pressure by hour (GMT) for: Oct ——— 29.803*
Nov - - - - 29.712*
Dec ——⸗—— 29.837*

LOCATION: RAF Alconbury
SOURCE: RUSSWO, 30 Nov 77

*Mean Station Pressure

2-1 Operationally Critical Terminal Forecast Elements. The critical values, customer(s), and activities affected by the operationally significant weather elements are listed in Table 2-2.

Table 2-2. Operationally Critical Terminal Forecast Elements

Parameter	Critical Values	Customer(s)	Activities Affected (Action Taken)
CIG/VIS (ft/nm)	200/0.5	17RW	Aircrew Minima
	300/0.9	10TRW	(PAR MINS)
	300/1.0(RVR55)	"	(CAT 1 MINS)
	400/0.9	"	(ASR/TACAN MINS RWY 30)
	500/0.9	"	(ASR/TACAN MINS RWY 12)
	500/1.3	"	(TACAN CIRCLING MINS RWY 12)
	500/1.5	"	(CAT II MINS)
	800/2.0	"	(CAT III MINS)
	1500/3.0	"	(FCF MINS, WING COMMANDER WAIVER)
	3000/3.0	"	(FCF MINS)
	5000/3.0	"	(FCF MINS, MAJOR MODIFICATION)
VIS (nm)	0.1	10TRW/MA	Aircraft and vehicle movement (reduce or cease) Movement of munitions (Cease)
		10TRW/RM	Off-base vehicle dispatch (Cease)
		10CSG	Vehicle traffic/school buses (Cease) Weapons storage area security (Increase manning)
	0.25	10CSG	On and off-base CE vehicle movements (Cease or reduce)
TEMP	36 & dew-point depression =/GT 6°	10TRW/MA	Engine operations on trim pads and flight line (Stop operations to avoid ice formation/FOD if inlet screens installed)
WIND (kts)	65	2166CS	Control Tower (Evacuate)
	52	2166CS	GCA (Evacuate)
	50	10TRW/MA	RF-4C (hangar/shelter aircraft) F-5E (hangar/shelter aircraft) F-15 (hangar/shelter aircraft) Transient (hangar/shelter fighter aircraft, Contact crew for advice on multi-engine aircraft)
	45	10TRW/RM	Fuel operations (Cease)
		10CSG	Standby (Emergency repairs and notification to PSA)
	40	10CSG	RSU (Move indoors)
		2166CS	GCA (Free-wheel ASR antenna if no mission impact)
		10TRW/MA	Prepare to hangar/shelter all aircraft F-5E (Park aircraft outside nose into the wind)
	35	10TRW/MA	All aircraft (curtail outside maintenence involving open canopies)

Table 2-2 (Continued)

Parameter	Critical Values	Customer(s)	Activities Affected (Action Taken)
WIND (kts)	35	10TRW/MA	All aircraft (Curtail outside maintenence involving open doors and panels, Close canopies) Hot film download (Cease)
	25	10TRW/MA	Munitions loading on aircraft outside shelters (limited to mission essential only)
		2166CS	HF Radio (Turn LP antennas into the wind)
		17RW	TR-1 (Cease towing)
CROSSWIND FACTOR (kts)	35 Dry	10TRW/DO	TKOFF/LNDG (Cancel/divert)
	30	36TFW/DET	F-15 Xwind max, wet or dry (Cancel/divert)
	20 Wet	527TFTAS	F-5E (cancel/divert)
	20 Dry	10CSG	DP (respond to catl emergencies)
	15 Wet	1TRS	RF-4C (Cancel/divert)
	15 Dry	95RS	TR-1 (Cancel/divert)
SNOW/ICE/ FROST	RCR 12	10TRW/DO	Aircraft operations (Minimum value for taxi, takeoff, or landing)
	1/2"	10CSG	Standby (Activate snow removal crews)
	Accumulation	10TRW/MA	Aircraft operations/maintenence (Close canopies, hangar, etc) Munitions maintenence (Cease if not mission essential)
		10TRW/DO	Computer operations (Power down if significant accumulation on power lines)
		10CSG	Driving (Take safety precautions) Standby Snow removal crews (Alert, ready equipment)
		2166CS	TACAN/MICROWAVE (Remove snow from antennas and microwave dish)
TSTM/LTG (Within stated NM)	10	10TRW/DO	Takeoff and landing given hail, strong winds, and heavy rains at airfield (Prohibited)
		10TRW/RM	Data automation (Prepare to cease)
		10TRW/MA	Flight simulator (Shut down)
		2166CS	GCA/TACAN (Blue power)
	5	10TRW/DO	Computer operations (Power down)
	3	10TRW/MA	Refueling (Cease) Munitions movement (Restrict)
		10TRW/RM	Supply computer/data automation (Cease)

SECTION 3 - Approved Local Forecast Studies and Rules of Thumb

3-1. North Sea Effect. The forecast study, North Sea Effect, June 1963, is an objective technique for forecasting ceilings less than 1000 feet and visibilities less than 1.0 nautical miles at RAF Alconbury when the surface winds over East Anglia are between 010 and 090 degrees magnetic and are forecast to continue from that direction. The overall procedures are outlined in 2WW Seminar #16. A simplified checklist is contained in **Figure 3-1.**

3-1.1. Type "A" Stable Airmass. A strong ridge exists over the western UK with general anticyclonic flow over the North Sea and Eastern England. Warm, moist air is advected over the ridge into the North Sea. This warm, moist air, coming into contact with the colder sea surface, is cooled and saturated in the lower levels. This saturated air is then advected into East Anglia in the form of stratus, it's height depending on wind speed, moisture content, and the time of the year.

3-1.1.1 With light surface winds over Anglia, the stratus is restricted to specific times to make it's initial appearance. It is prevented from moving in at night by a radiational inversion that acts as a block. The stratus, if it forms at all, can be expected in the evening before the winds cease, or shortly after sunrise as the winds begin to rise. The stratus may not form at all if the dew point of the air over the sea is significantly lower than the sea temperature.

3-1.1.1.1 In the winter months ceilings can be expected to be very low, 200-300 feet at night and 500-600 feet during the day. An especially bad situation arises when the surface of the ground is much colder than the air being advected over it. Under these conditions, ceilings and visibility can be expected to go below 200 and .5. In mid-winter the stratus is likely to persist all day, clearing only with a change of airmass or wind direction.

3-1.1.1.2 In the summer months ceilings are higher, 600-300 feet, and insolation usually dissipates the stratus by mid-morning. Upper cloud cover, usually scarce during this synoptic situation, can cause the stratus to remain until midday.

3-1.1.1.3 If stratus does not form over the sea, clear skies will often bring about another type of North Sea Effect. Prolonged flow from the sea raises the moisture content of the air over Anglia. This, coupled with upslope, will often bring about radiation advection fog. Such fog can form in either of two ways: If there is a slight movement of air from the northeast, upslope will cause the fog to form inland first and then build back toward the sea, or because of the higher dew points nearer the sea, the fog could form there first and then extend gradually inland. Whichever way it happens, the forecaster at Alconbury will usually receive forewarning provided he watches stations both up and down stream. The fog formed in this manner is often quite dense with ceiling and visibilities below 200 and .5. Shortly after sunrise as the winds begin to blow, the fog generally rises to form a stratus layer at 300-400 feet. With moderate easterly flow and clear skies over the sea, the fog will clear by mid-morning. During the winter, very light winds could cause the fog to persist throughout the day! During the summer, insolation usually burns the fog off early.

3-1.1.2 With moderate winds over Anglia, the lower 1000-2000 feet of the air mass is mixed. A mixing inversion is formed around 1500-2000 feet. Stratus forms at the base of this inversion and then thickens downward. This type of stratus is generally higher than that with light winds, and it's movement is not restricted to any particular time of day, although, during the summer, convective currents may break it up along the coast. Dew points, although they do determine the stratus height, are not critical in the formation of this type of stratus.

3-1.1.2.1 During winter the stratus will tend to persist throughout the day, clearing only with a change of air mass or wind direction. Each day that the situation exists, the stratus will tend to become lower and thicker. Visibility will be generally above three miles during the day, but may go as low as 1/2 to 2 miles at night.

3-1.1.2.2 In summer, insolation usually breaks the stratus layer by early forenoon, but if the situation persists for several days, each day will require longer to break until the point is reached where clearing does not occur. Reduced visibility is generally not a problem.

3-1.2 Type "B" Stable/Unstable Airmass. A low center moves across southern England to the south of Alconbury. There are many variations of this type, but the general movement is from west to east. They are usually associated with a frontal system separating warm, moist air to the south from maritime polar air. Lows wholly within polar air do occur but are not common.

3-1.2.1 Warm, moist air is forced out over the sea, mixed with polar air, cooled by the sea surface, and then advected back over Anglia. This type of stratus is usually layered and almost always accompanied by higher clouds and precipitation. Ceilings as low as 300-400 feet can be expected during the winter and 700-800 feet during the summer. Visibilities will vary from 0-2 miles during the winter and 1-3 miles during the summer. If the low happens to be entirely within polar air, ceilings can be expected in the 1000-1500 foot range, and shower activity will be common.

3-1.2.2 What is most significant about this type of stratus is it's ability to mislead. Just when it looks as if conditions should start to improve, the backlash from around the northwest quadrant of the low arrives. Low ceilings with this type of system are generally short-lived--six to twelve hours, depending on the speed of the low and it's trajectory. If a low stagnates in the North Sea, low ceilings will remain for an extended period of time.

3-1.3 Type "C" Unstable Airmass. Like type "A" ridging occurs over the western portions of the UK. The flow over the North Sea is usually cyclonic, but can be anticyclonic. At the 500MB level a long northerly trajectory is present. The airmass is unstable--colder than the surface it is being advected over. This type causes shower activity, both over the sea and East Anglia.

3-1.3.1 Cumulus and showers first appear along the coast. This activity may be recognized earlier provided there are ship reports from the North Sea. Once this type of situation is established, it is just a matter of using wind trajectory and speed to determine the time at which showers can be expected at Alconbury.

3-1.3.2 With cyclonic flow, ceilings during the day are generally broken, 1500-2000 feet in the summer and 300-1500 feet in the winter. At night the skies

become scattered variable to broken with an occassional shower. Visibilities will be good both night and day except in showers. Heavy snow showers with obscured ceilings are not uncommon from November to March.

3-1.3.3 With anticyclonic flow skies will at first be mostly scattered with isolated showers. Visibilities will be fair except during the night when ground fog reduces the visibility to 1/2 to 2 miles during the winter and 2-3 miles during the summer. If the condition persists for over 24 hours, and a low inversion is formed, an overcast layer of cumulus and stratocumulus will form at the base of the inversion. The longer this condition lasts the lower the ceiling and visibility will become. Under extreme conditions, the overcast may become dense nimbostratus with rain. When this happens, ceilings 300-400 feet and visibilities of 1/2 to 2 miles are common.

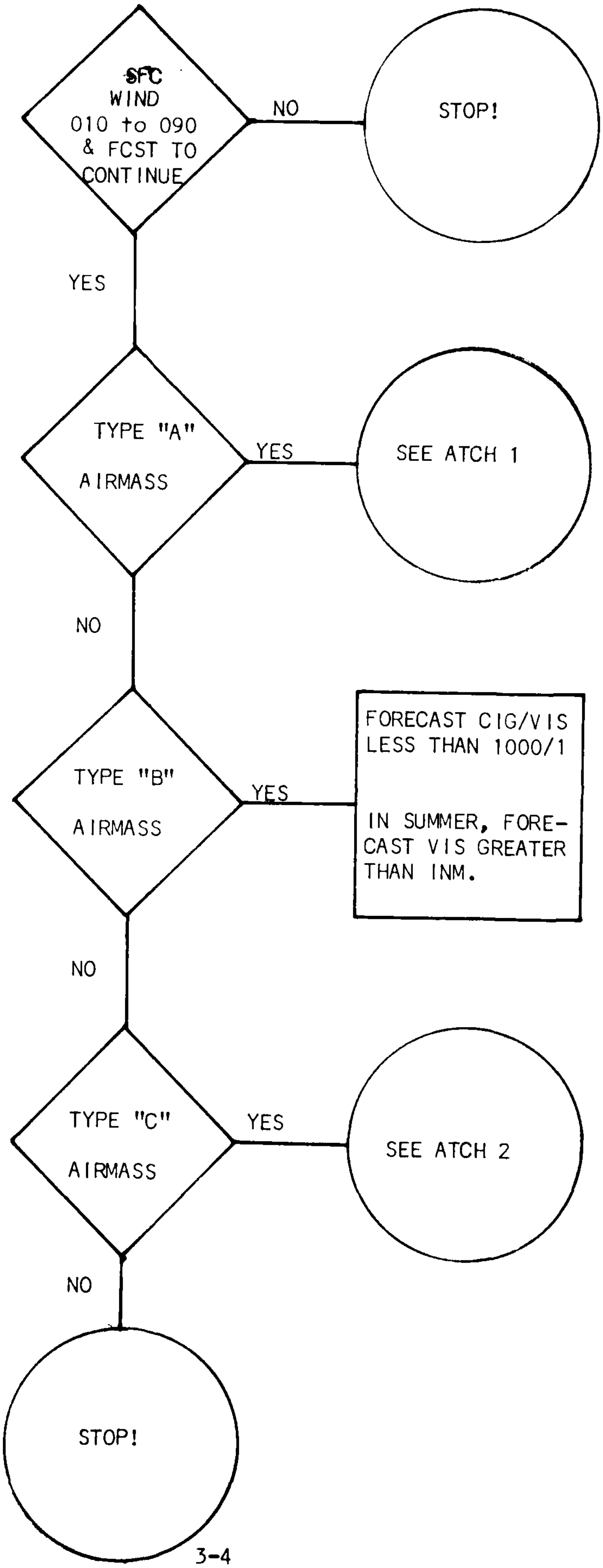


Figure 3-1. North Sea Effect Flowchart.

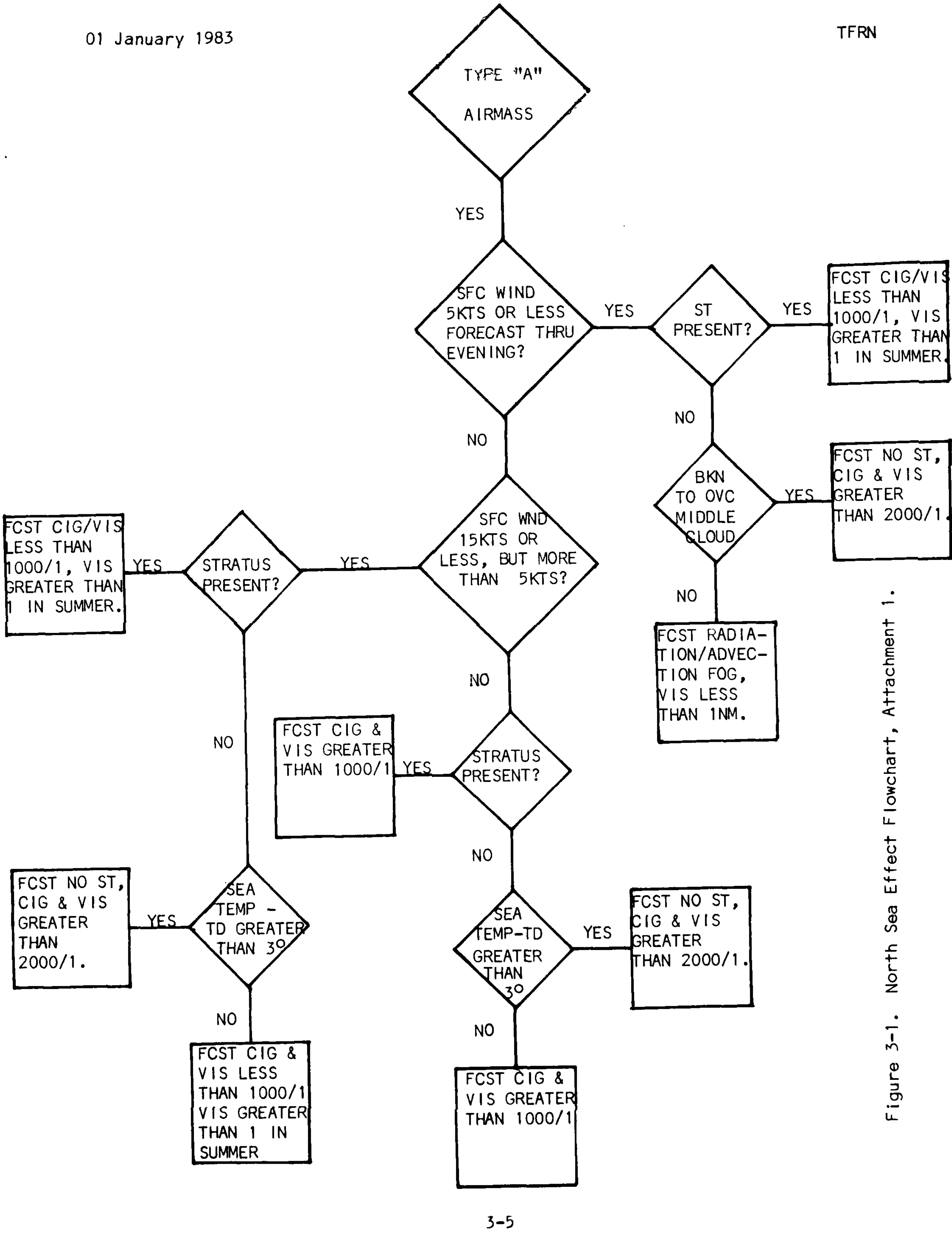


Figure 3-1. North Sea Effect Flowchart, Attachment 1.

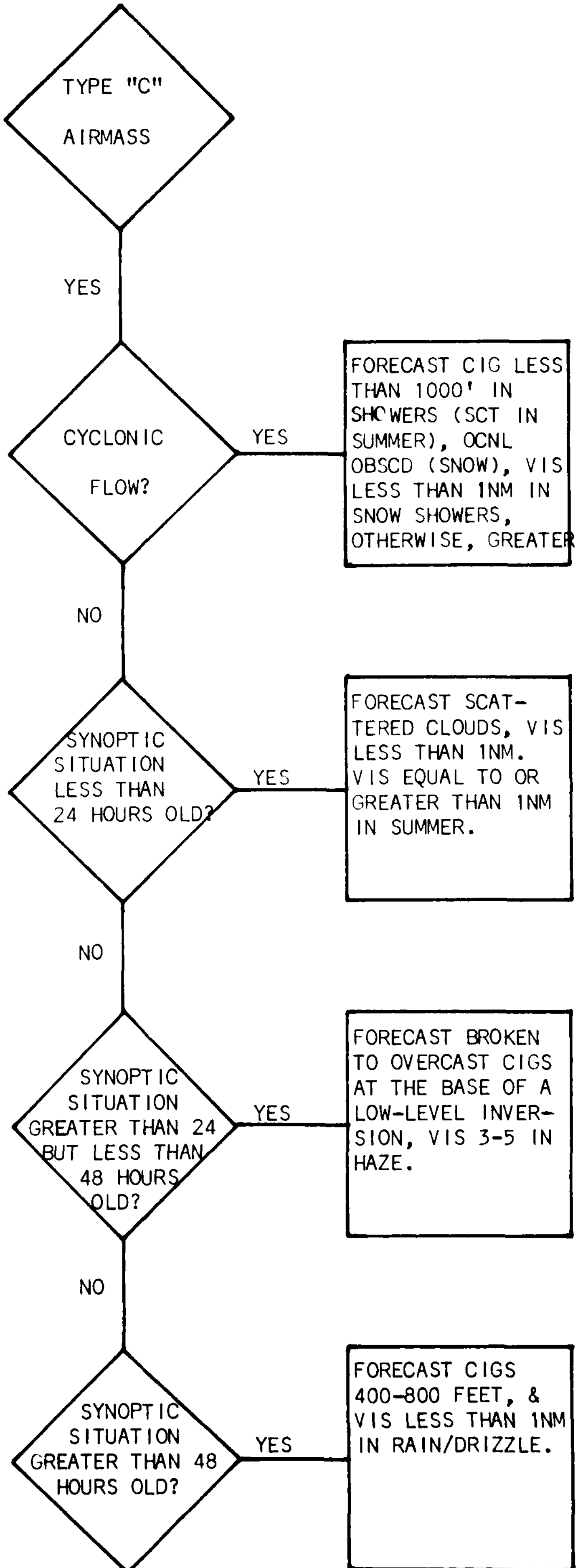


Figure 3-1. North Sea Effect Flowchart, Attachment 2.

3-2 Barbera's Wind Forecasting Technique. In this study, the average gradient level winds and the surface pressure gradient along various line segments are used to determine peak gusts. Beginning in November 1976, the peak gust forecasts determined by the line segments were further refined to help account for low-level stability.

3-2.1 Procedures.

3-2.1.1 Using the gradient level winds:

3-2.1.1.1 Calculate the average gradient level winds ($\overline{GW}$) for RAOB station combinations 308 and 496 and 322 and 774. For example, if 308 and 496 are showing gradient winds of 40 and 32 respectively, $\overline{GW}$ = 36; if 322 and 744 are showing 45 and 35 respectively, $\overline{GW}$ = 40.

3-2.1.1.2 Determine the forecast wind direction.

3-2.1.1.3 Enter the appropriate gradient level Nomogram (I through IV) using the direction and $\overline{GW}$ to determine the peak gusts for the 12 hours after the time of the data used. Example: Given a wind direction of 290-340 and $\overline{GW}$ (308 and 496) = 36 and $\overline{GW}$ (332 and 774) = 40, expected peak gusts would be greater than 30 KTS but less than 35 (from graph IV).

3-2.1.2 Using the Surface Pressure Gradient:

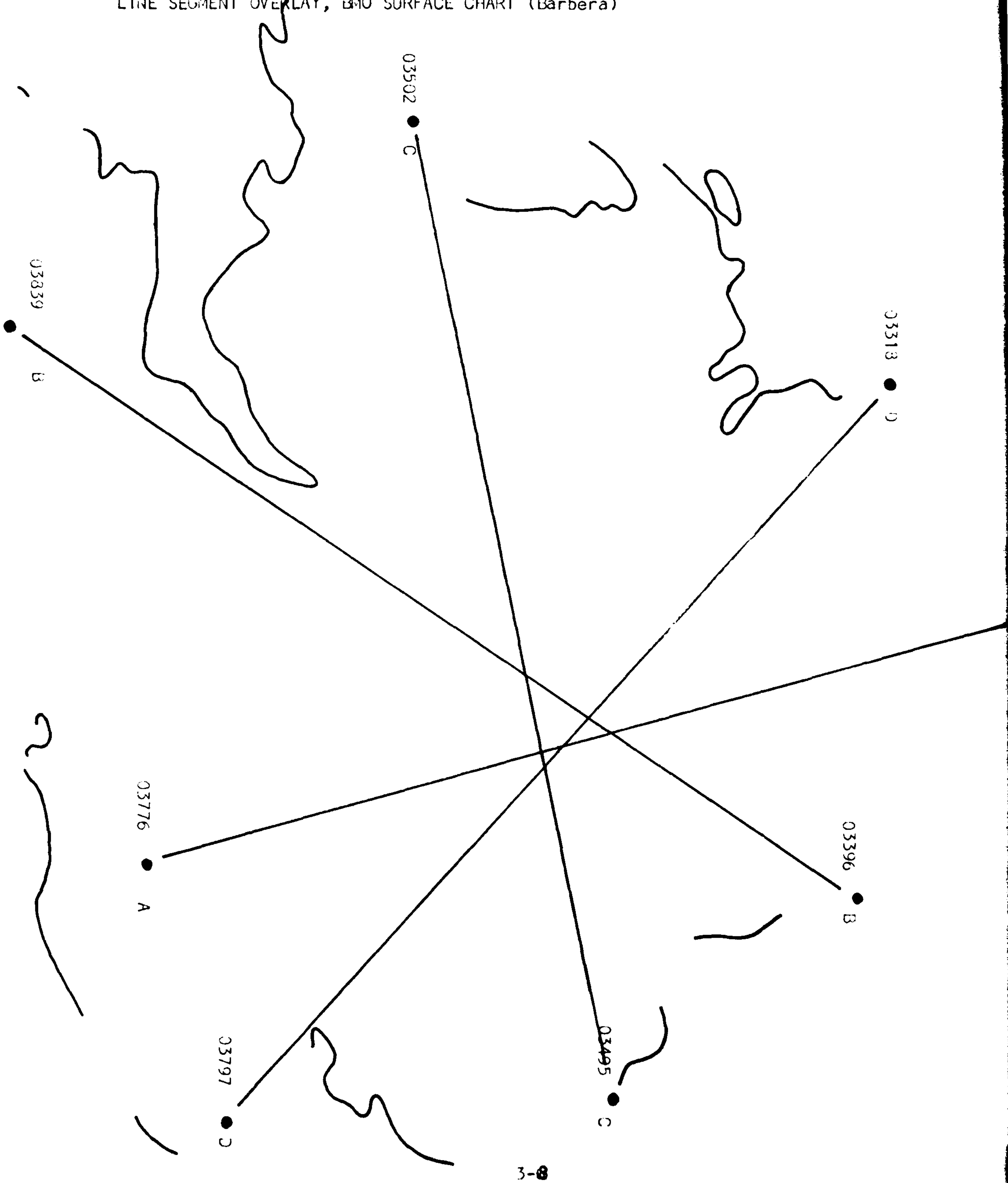
3-2.1.2.1 Align the Peak Wind Line Segment Overlay with the latest LAWC and locate the segment which is most nearly perpedicular to the isobaric flow. If the flow falls between two segments, compute values for both segments and determine an average.

3-2.1.2.2 Calculate the pressure difference between the end stations. Example: If the line segment B is used with station 339 reporting a pressure of 1010.4MBS and station 396 showing 995.4MBS, the difference would be 1010.4-995.4 = 15. (Use absolute value).

3-2.1.2.3 Multiply this value by 3 to arrive at a first guess peak gust (3x15=45).

3-2.1.2.4 Correct this value for atmospheric stability using Table 3-1 A correction factor for both an unstable (U) and stable (S) situation is determined by entering the table on the left along the forcast wind variance and then reading the correction factor values indicated under the appropriate line segment. Example: Given a variance of 290-340 our correction factors for line segment B would be U = .95 and S = .70 (the highest value in the wind direction variance is always used). Multiply the first guess peak gust (determined above) by these values to arrive at a corrected peak gust forecast , this can be done easily using table 3-2.

LINE SEGMENT OVERLAY, BMO SURFACE CHART (Barbera)



LINE SEGMENT OVERLAY, HAND PLOTTED SURFACE CHART (Barbera)

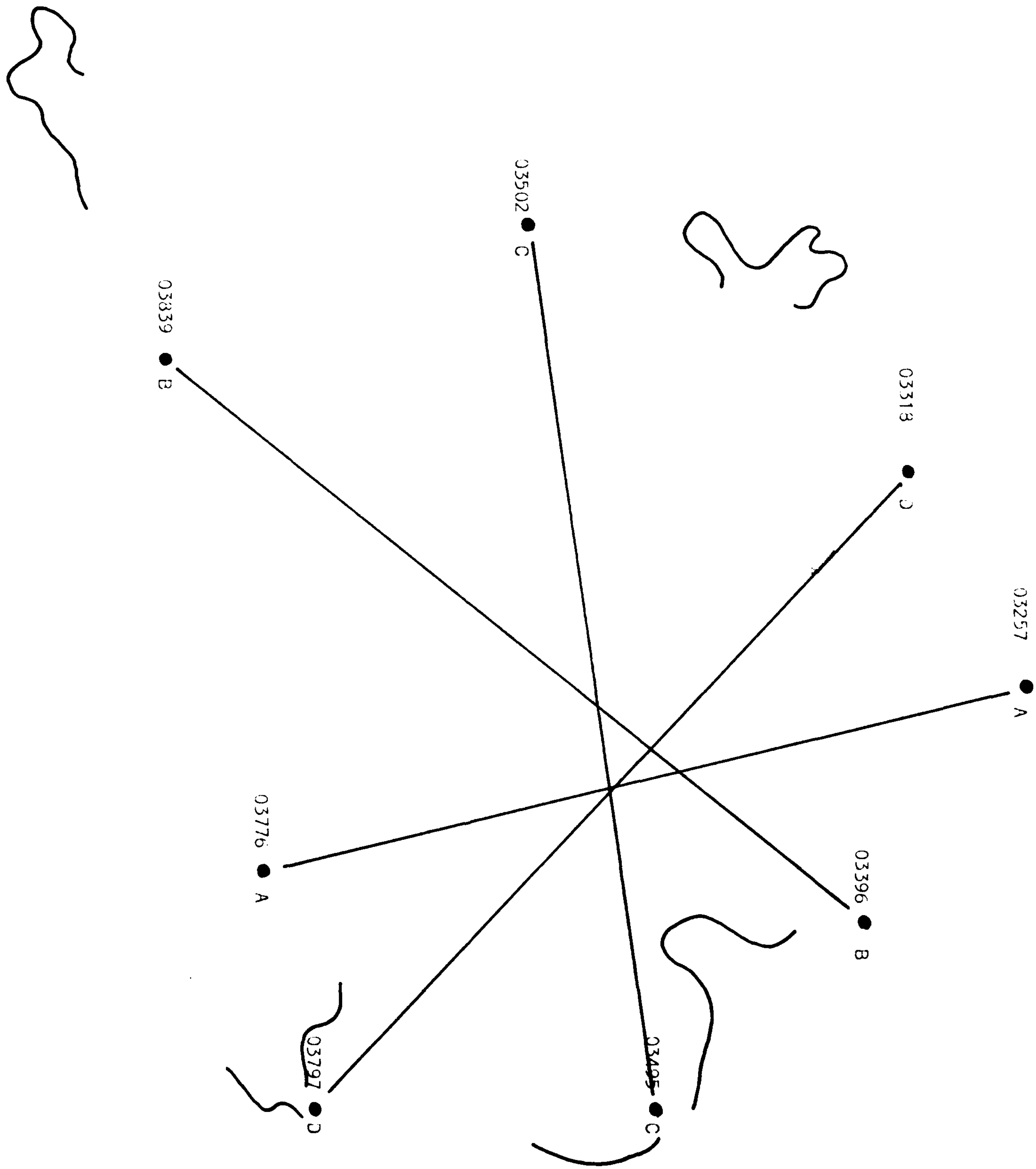


Table 3-12. Correction Factor (based on wind direction, line segment and stability)

WIND DIR	Line Segment A U	A S	B U	B S	C U	C S	D U	D S
010	.95	.40	.95	.50	.90	*	.95	*
020	.95	.40	.95	.40	.90	*	.95	*
030	.90	.40	.95	.40	.90	.50	.95	*
040	.90	.40	.90	.40	.90	.50	.95	*
050	.90	.40	.90	.40	.90	.40	-	-
060	.90	.40	.90	.40	-	-	-	-
070	-	-	.90	.50	*	.30	-	-
080	.95	.50	.95	.50	*	.30	-	-
090	.95	.50	.95	.50	*	.30	-	-
100	.95	.50	.95	.50	*	.30	-	-
110	.95	.50	.95	.50	-	-	-	-
120	.95	.50	.95	.50	-	-	-	-
130	.95	.50	-	-	.80	*	-	-
140	-	-	-	-	.80	.40	-	-
150	-	-	-	-	.80	.40	-	-
160	-	-	-	-	.80	.40	-	-
170	-	-	-	-	.80	.50	.80	.40
180	-	-	-	-	.80	.50	.80	.40
190	-	-	-	-	.90	.60	.80	.40
200	-	-	-	-	.90	.60	.90	.50
210	.95	.50	-	-	.90	.60	.90	.50
220	.95	.50	-	-	-	-	.95	.50
230	.95	.50	*	.50	-	-	.95	.50
240	.95	.50	*	.50	-	-	.95	.50
250	.95	.40	.80	.50	-	-	.95	.50
260	.90	.40	.80	.50	-	-	.95	.50
270	.90	.40	.70	.50	-	-	-	-
280	.95	.40	.80	.50	-	-	-	-
290	.95	.40	.90	.60	-	-	-	-
300	.95	.40	.90	.60	.80	*	-	-
310	-	-	.95	.70	.80	*	-	-
320	-	-	.95	.70	.80	.60	-	-
330	-	-	.95	.70	.90	.60	-	-
340	-	-	.95	.60	.90	.50	-	-
350	-	-	.95	.60	.90	.50	.95	.70
360	.95	.40	.95	.50	.90	.50	.95	.70

U = Unstable S = Stable * No data available

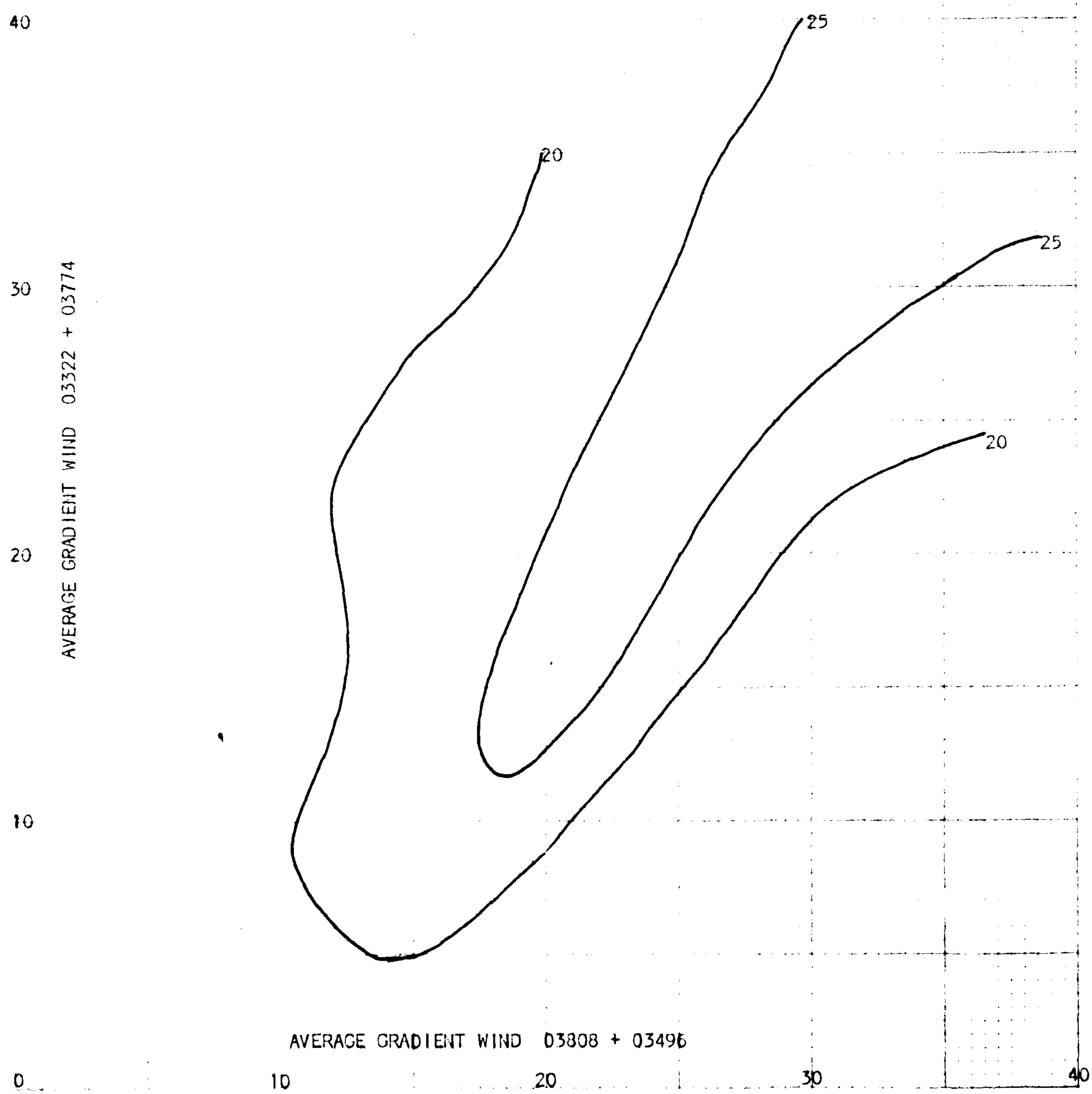
Table 3-2. Surface Gradient Forecast

3X	Correction Factor							
	.3	.4	.5	.6	.7	.8	.9	.95
20	6	8	10	12	14	16	18	19
22	7	9	11	13	15	18	20	21
24	7	10	12	14	17	19	22	23
26	8	10	13	16	18	21	23	25
28	8	11	14	17	20	22	25	27
30	9	12	15	18	21	24	27	29
32	10	13	16	19	22	26	29	30
34	10	14	17	20	24	27	31	32
36	11	14	18	22	25	29	32	34
38	11	15	19	23	27	30	34	36
40	12	16	20	24	28	32	36	38
42	13	17	21	25	29	34	38	40
44	13	18	22	26	31	35	40	42
46	14	18	23	28	32	37	41	44
48	15	19	24	29	34	38	43	46
50	15	20	25	30	35	40	45	48
52	16	21	26	31	36	42	47	49
54	16	22	27	32	38	43	49	51
56	17	22	28	34	39	45	50	53
58	17	23	29	35	41	46	52	55
60	18	24	30	36	42	48	54	57
62	19	25	31	37	43	50	56	59
64	19	26	32	38	45	51	58	61
66	20	26	33	40	46	53	59	63
68	20	27	34	41	48	54	61	65
70	21	28	35	42	49	56	63	67
72	22	29	36	43	50	58	65	68
74	22	30	37	44	52	59	67	70
76	23	30	38	46	53	61	68	72
78	23	31	39	47	55	62	70	74
80	24	32	40	48	56	64	72	76

To determine surface gradient wind forecast, enter table using 3X and correction factor based on stability and forecast wind direction (See Table 3-2).

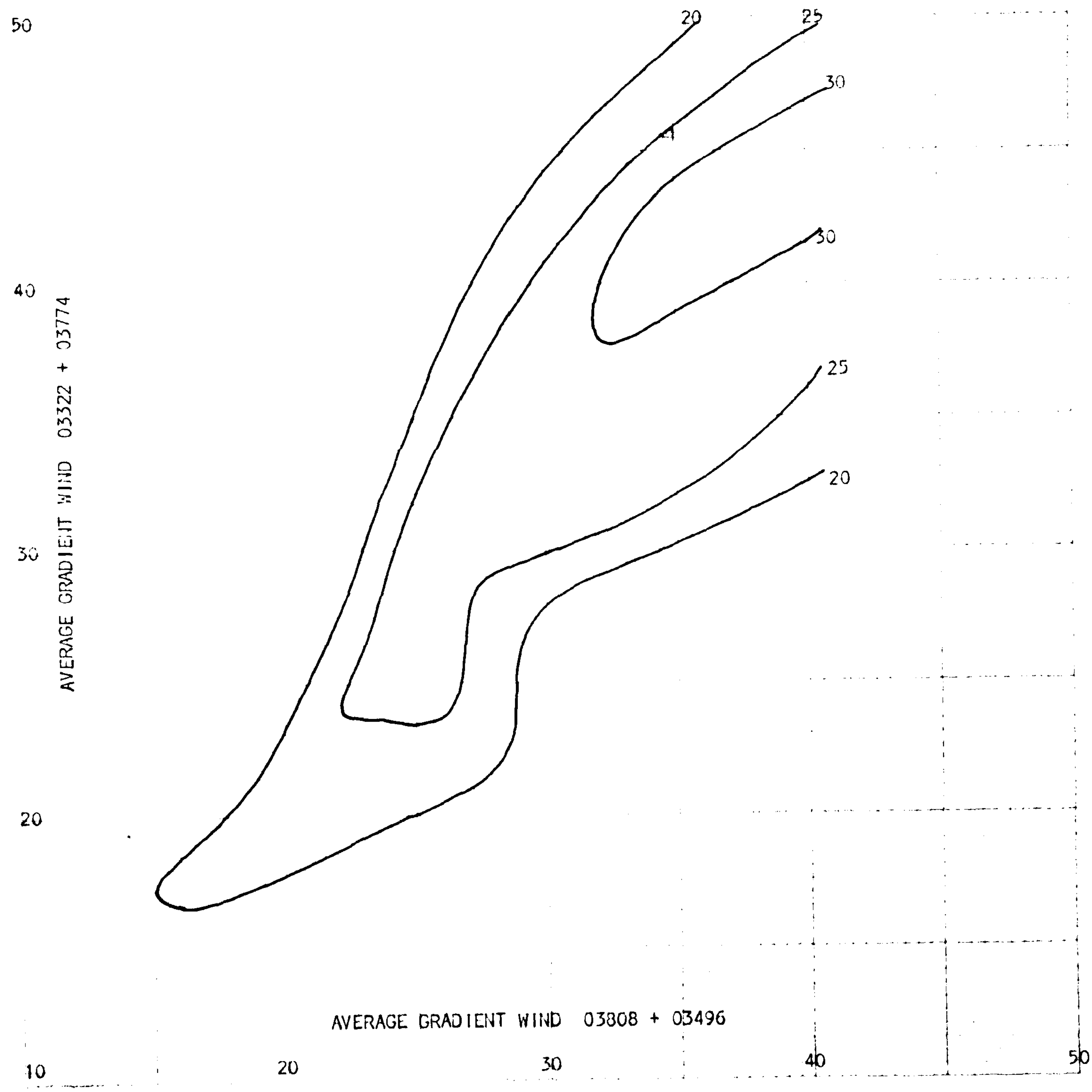
GRADIENT LEVEL NOMOGRAM I

Surface Wind Direction 360-090



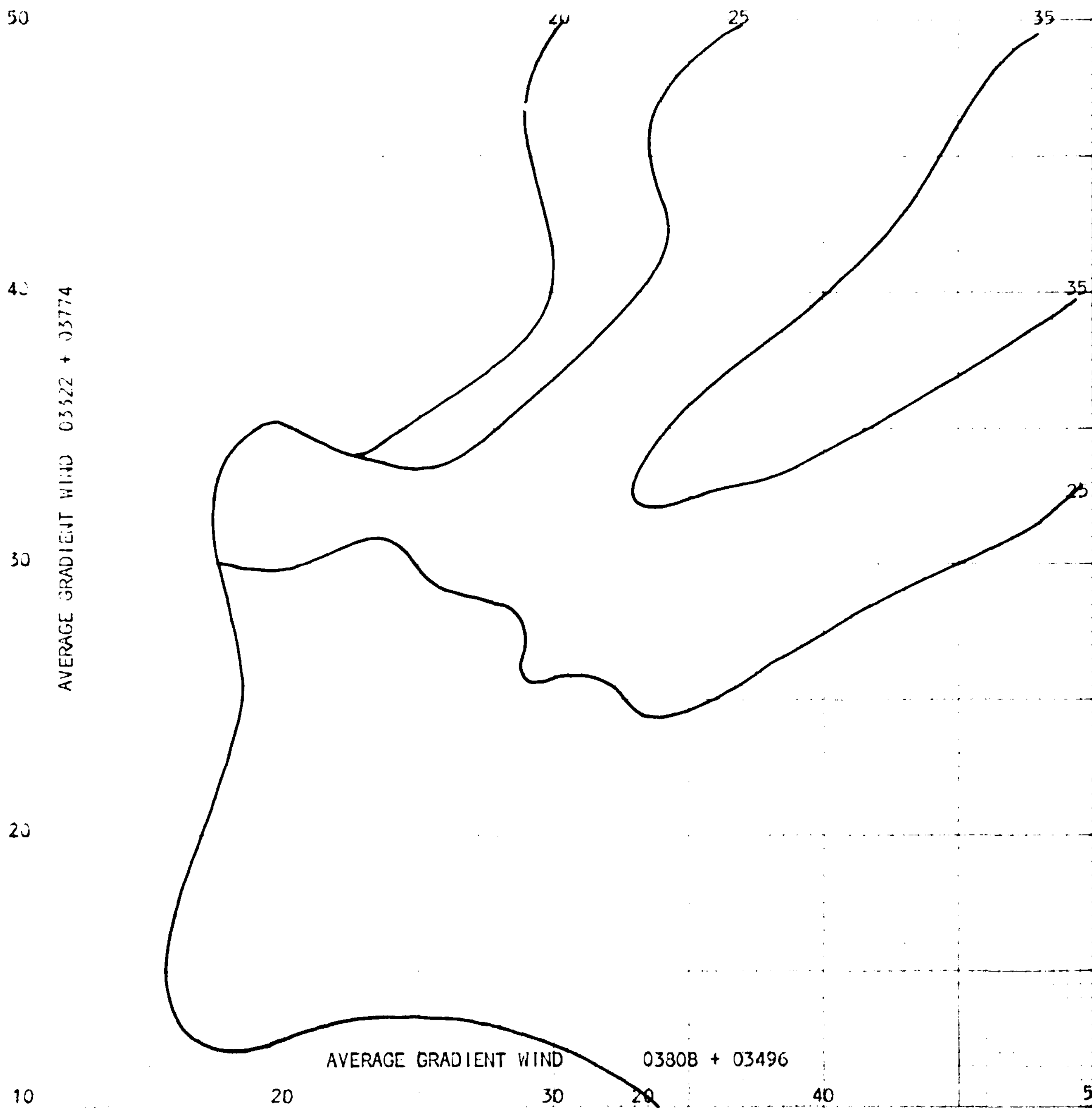
GRADIENT LEVEL NOMOGRAM II

Surface Wind Direction 090-180



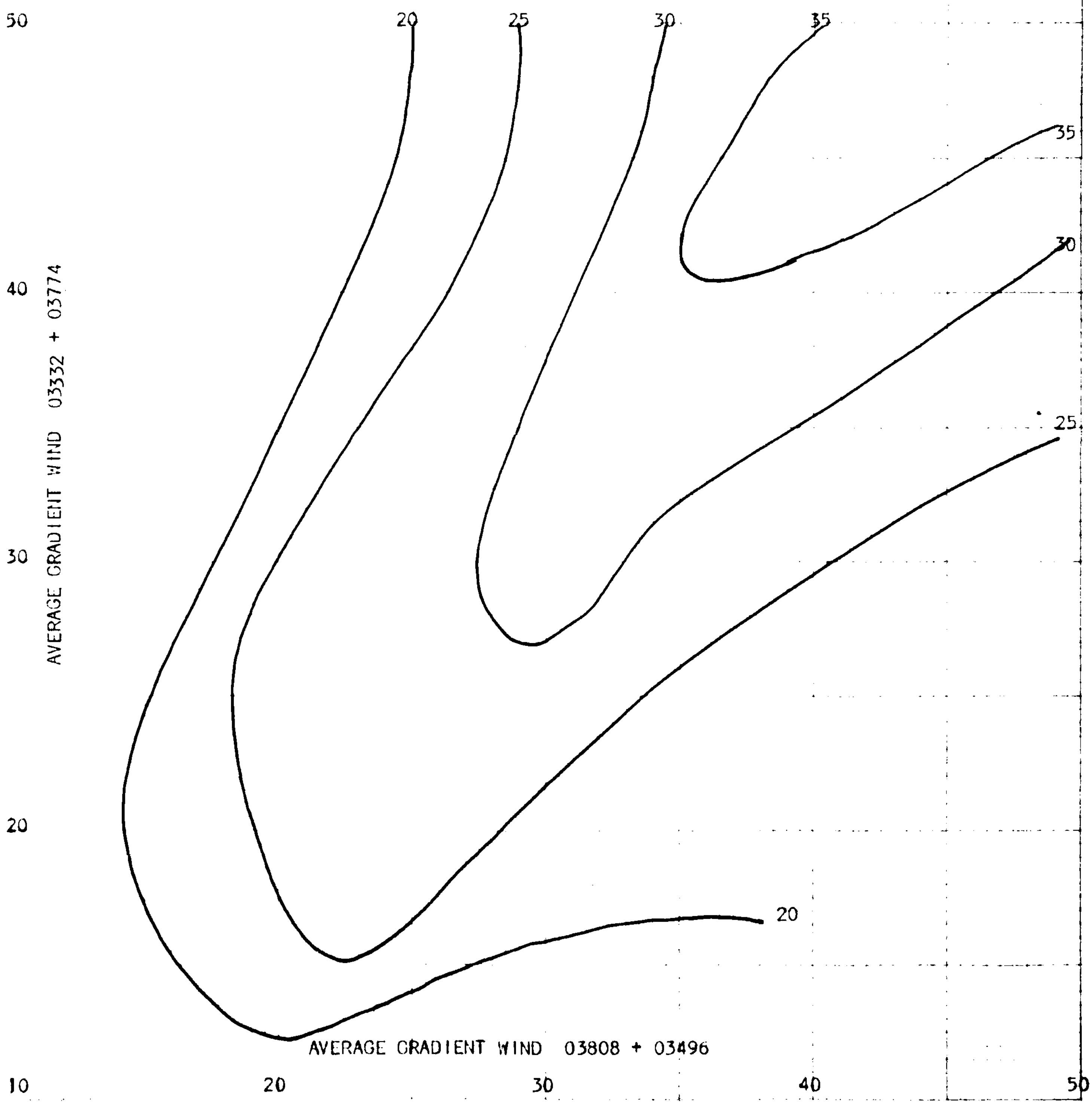
GRADIENT LEVEL NOMOGRAM III

Surface Wind Direction 180-270



GRADIENT LEVEL NOMOGRAM IV

Surface Wind Direction 270-360



SECTION 4 - Weather Controls And Synoptic Case Studies.

4-1 General: The climate of the United Kingdom (UK) is milder than that of comparable latitudes in other parts of the world due to the North Atlantic Ocean and the prevailing westerlies. The proximity of warm water, even as far north as the Arctic Circle, prevents long periods of cold weather as observed in Russia and Asia.

4-1.1 Our weather is similar to that found along the west coast of North America, although there are no significant north-south mountain ranges to block the flow of westerly winds from the North Atlantic as in the case of North America. Very little protection is afforded the base from the southwest to west. The downslope motion is also not enough to create a pronounced drying effect. Moist air from the southwest to the west is advected over the base with negligible modification. Therefore, we experience a maritime climate with very mild winters, cool summers, frequent cloudiness and fog, and fairly evenly distributed precipitation.

4-1.2 The main air flow over England during the winter is southwesterly. The predominant system is a northeastward extension of the deep semi-permanent low centered south of Iceland. The principle variation from winter to summer circulation is the intensification and northward displacement of the Atlantic High. Figure 4-1 illustrates the mean pressure, circulation, and wind flow by season while figure 4-2 shows the mean winter and summer positions of the semi-permanent synoptic features. Figure 4-3 shows the primary and secondary mean cyclone paths by season.

4-1.3 The Gulf Stream dominates the circulation of the North Atlantic with the result that warm water is transported northeastward from the southwestern Atlantic toward northwestern Europe. Throughout the major portion of the year, maritime airmasses dominate. The winters are generally mild with moderately high humidities. Summers are relatively cool with high humidities.

4-2 Major Airmasses. The major airmasses that affect the UK are as follows:

4-2.1 Maritime Arctic (mA). This air moves southward from the Arctic on the rear of a deep depression over Scandanavia. The clouds are chiefly cumulus and cumulonimbus and showers are frequent in winter and early spring (snow showers). The north wind is generally cold and visibility good.

4-2.2 Maritime Polar (mP). The air moves into the British Isles from the western North Atlantic. This is the most common air mass over the UK. It occurs in the rear of cold occluded fronts which are associated with depressions to the north and northwest. Cumulus and cumulonimbus are the most frequent cloud types and showers are common in spring and autumn. Thunderstorm activity is likely in the summer.

4-2.3 Continental Arctic (cA). This air brings frost into the eastern and southeastern UK. The visibility is usually lowered by haze. The clouds are generally stratocumulus of fair weather cumulus.

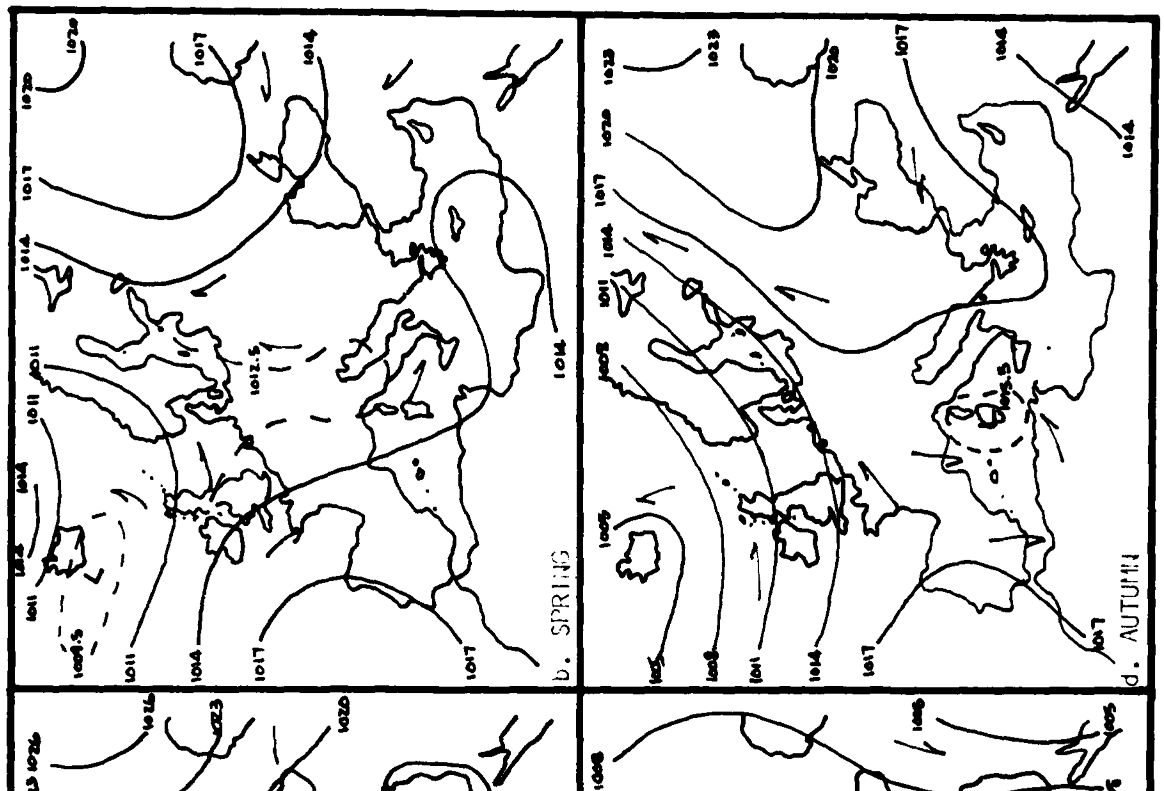


Figure 4-1. Mean Sea Level Pressure, Circulation, and Wind Flow by Season.

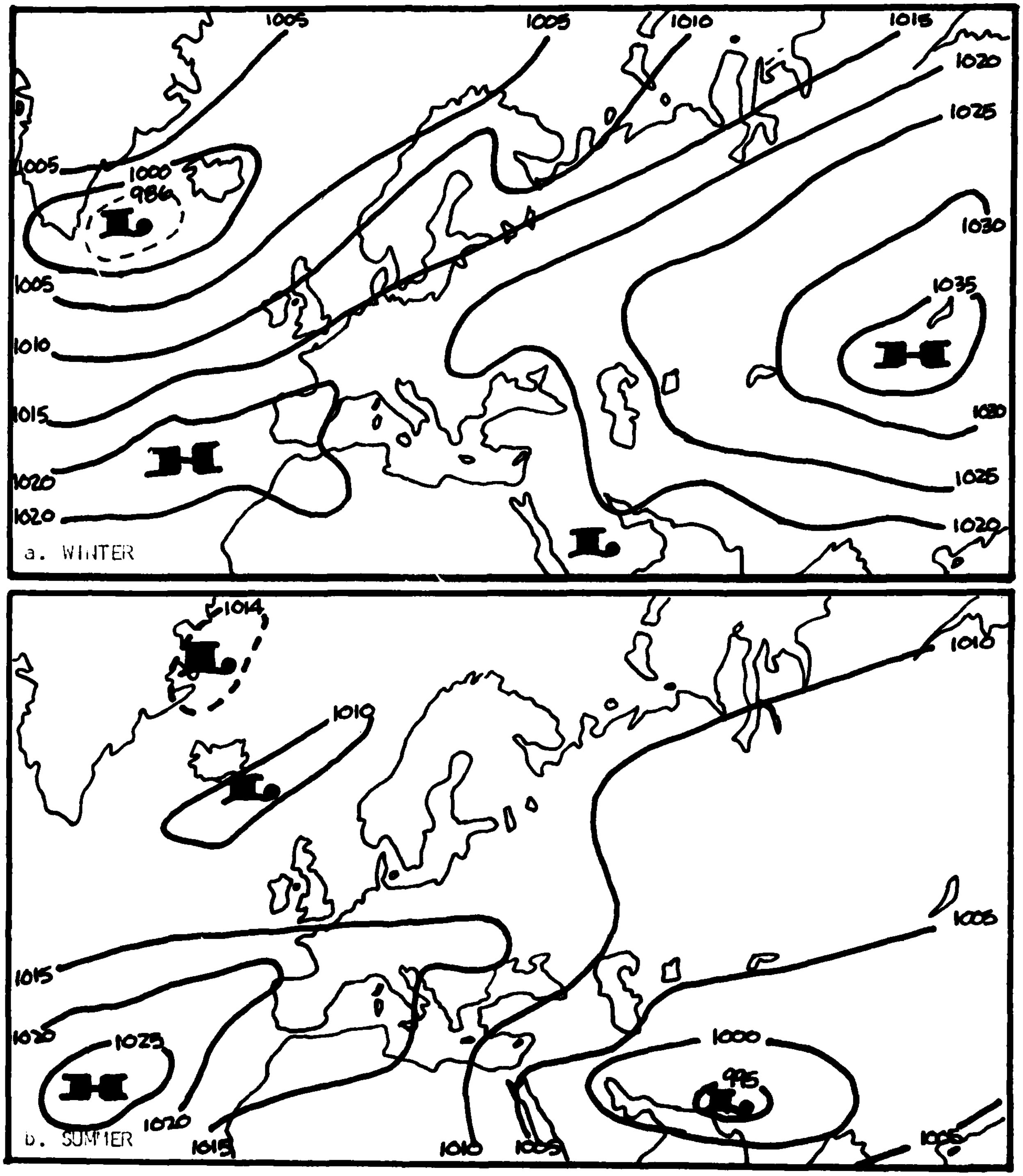


Figure 4-2. Mean Winter and Summer Positions of the Semi-permanent Synoptic Features.

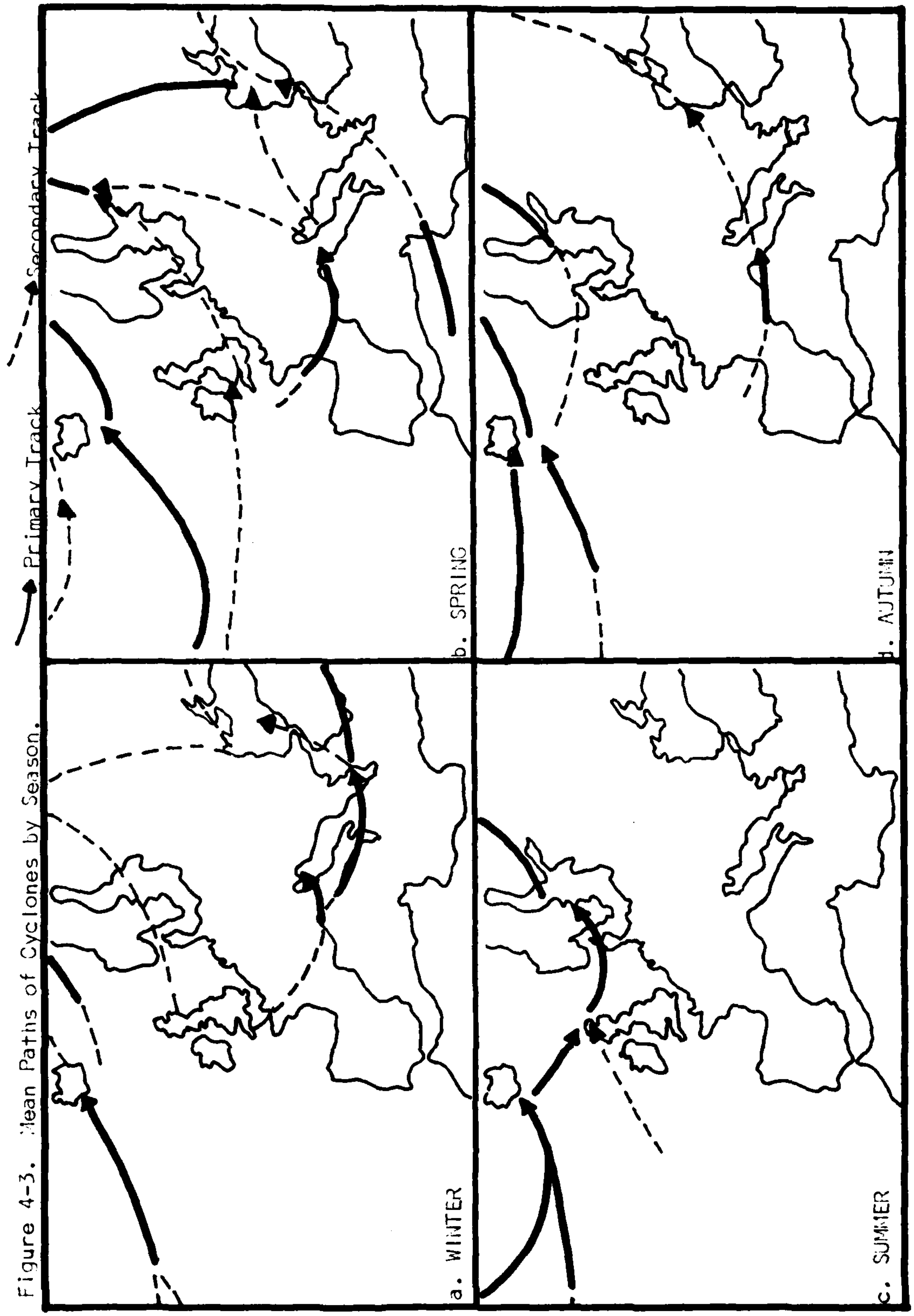


Figure 4-3. Mean Paths of Cyclones by Season.

4-2.4 Continental Polar (cP). This air reaches the UK after originating over Finland, Lapland, or Russia. There is little cloud formation except for fair weather cumulus in the afternoon. Visibility is lowered by haze and smoke from the industrial areas.

4-2.5 Maritime Tropical (mT). This air originates in the Azores High Pressure area. It is relatively warm and moist in the warm section of a depression. The wind is usually strong from the southwest. The conditions are mild in autumn and spring and moderate in summer. Orographic rain and drizzle occur in all seasons. The clouds are normally stratocumulus, nimbostratus, altocumulus, and altostratus.

4-2.6 Maritime Polar (mP). This air approaches the UK over the Atlantic Ocean. It follows the southerly maritime polar tracks. It often gives orographic rain and drizzle along the coasts and hills. Clouds are mostly cumulus and stratocumulus.

Figure 4-4 illustrates each of these airmasses.

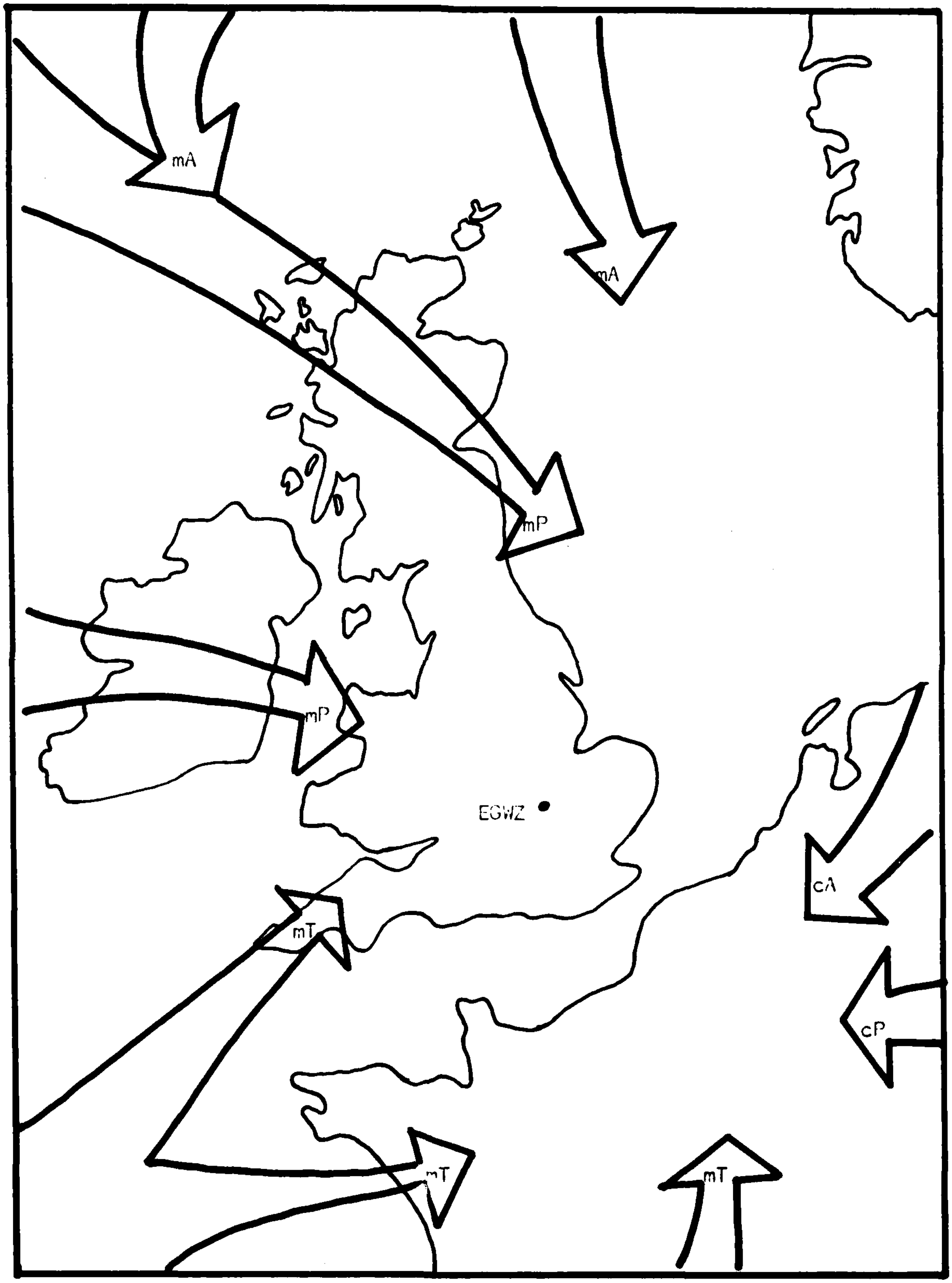


Figure 4-4. Major Airmasses Affecting RAF Alconbury

4 General Weather Discussion:

4-3.1 Clouds and Visiblity. Low clouds and reduced visibility are often associated with frontal systems and troughs from late fall through early spring. Stratus ceilings of 800 to 1200 feet and visibilities of 2 to 4 miles usually accompany cold fronts, occluded fronts, and troughs during passage. Warm fronts from the southwest produce stratus at 400 to 800 feet with 2 to 4 mile visibilities lowering to 200 to 400 feet and 1 to 2 miles with frontal passage. Stratus usually prevails in the warm sector above 600 feet and is generally free of upper clouds. Frontal passages at other times of the year produce higher ceilings and visibilities. An established flow from the northeast can produce low stratus, especially associated with a high pressure system. The stratus forms under a subsidence inversion with bases as low as 500 feet and tops below 5000 feet. In the cold months a continued influx of cold air from Scandanavia over the relatively warm waters of the North Sea produces unstable conditions conducive to heavy snow showers along the northeast coast that often move inland to Alconbury. We generally experience good weather year round with a high over west central Europe, although some restrictions (1 to 2 miles) may be expected from November to March due to industrial haze and the lack of insolation. Conversely, if a low becomes stationary over the North Sea, we will have low ceilings 300 to 500 feet with visibilities 1 to 3 miles with rain. This situation occurs at any time of the year. Fog can also occur year round but is most common from November to March. Radiation causes most of the fog, however, it may be advected from any direction, particularly with an easterly component. The Wash or Fens are the most conducive areas for fog formation. Smoke pollution can occur from the Peterborough area or from the industrial areas to the southeast. Radiation fog which forms from April through October generally dissipates rapidly after sunrise.

4-3.2 Precipitation. Our average annual precipitation is about 22 inches, spread rather evenly throughout the year. The occurrence of measurable precipitation is frequent (about 100 days) but mostly light. Snow showers are likely from November to April with cold unstable north to northeasterly flow. Snow accumulation is most apt to occur when an east-west frontal system moves south of the station and a low or wave moves along the front. Thunderstorms are most prevalent from May through October. Usually the thunderstorms are activated in France and given southerly flow, tend to drift across the channel to southern England during the late afternoon and evening. Thunderstorms are rare during the winter, usually occurring with fast moving cold fronts.

4-3.3 Surface Winds. Surface winds are southwest to west a majority of the time with occassional gusts to 35 knots. Gale force winds can be expected with a deep low moving near the base. With strong northwesterly flow, the winds reach gusts of 25 to 35 knots in the afternoon and up to 45 knots with a cold front. Gusts to 50 knots (extreme maximum 65 knots) have been recorded with very deep, fast moving cold fronts.

4-4 Synoptic Case Studies. Some common weather types are outlined in figures 4-5 through 4-11. More detailed case studies (forecast reviews) are filed in the Forecast Review Binder.

The Catalog of European Large Scale Weather Types (BAUR Types) is filed in the forecast work center.

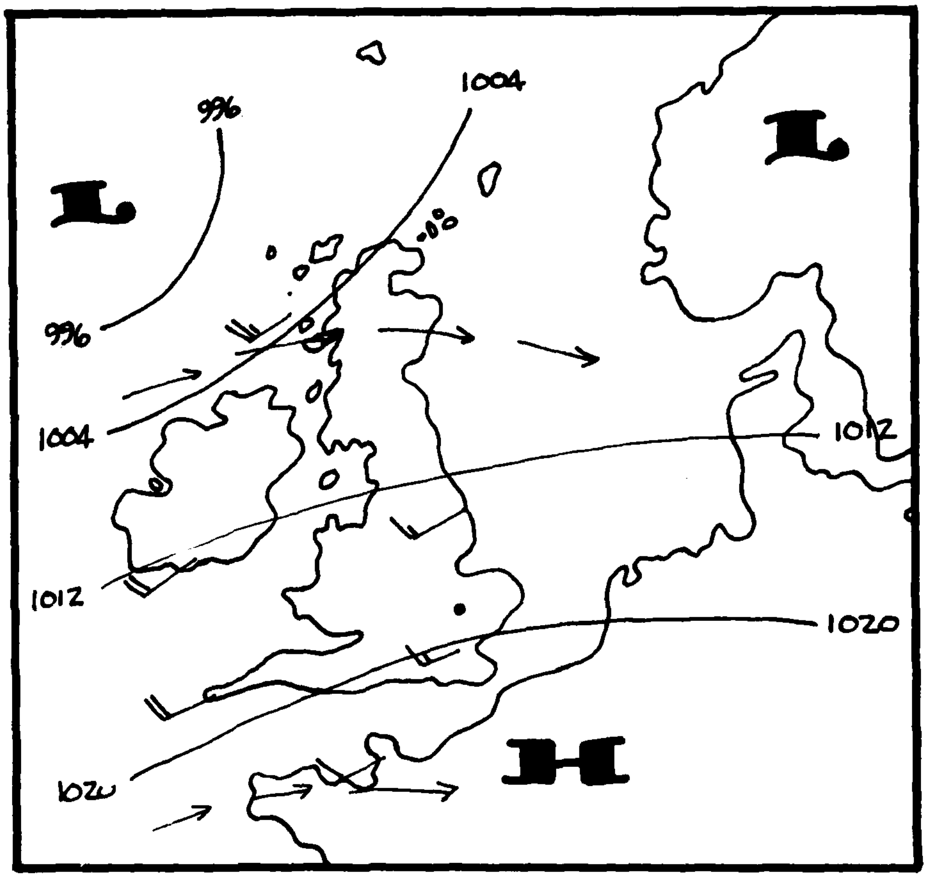


Figure 4-5. Normal Southwesterly Type.

Type A: Low pressure to the north or northwest of the British Isles with a general windflow from the southwest to west. It occurs with great frequency at all times of the year but is most frequent during winter. The main depression is centered south of Iceland and the pressure gradient over the British Isles is not very steep (light to moderate winds). Because of the long trajectory over water, the air has a high moisture content and often produces an abundance of rainfall in Ireland, Scotland, and southern England. Fronts tend to slide to the north of Alconbury, with very little precipitation east of Greenham Common and Upper Heyford. We generally have light rain with a warm frontal passage, broken clouds with westerly flow, and extensive low-layer stratus with southwesterly flow. In the summer, broken cumulus and rain showers occur during the late morning to mid-afternoon period. Visiblity is occassionally lowered to 1 to 2 miles in haze and fog, but lifts quickly after sunrise. Thunderstorms occur occassionally in the afternoon.

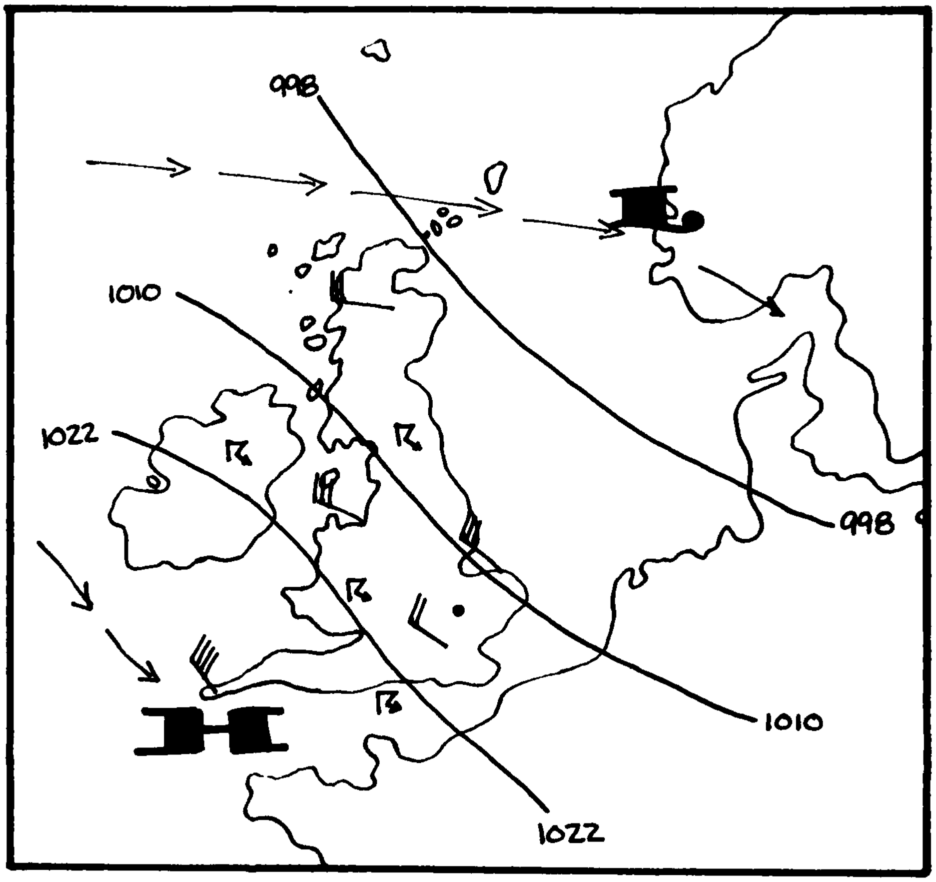


Figure 4-6. Northwesterly Type.

Type B: Low pressure to the northeast, high pressure to the south or southwest. It generally occurs throughout the year, but is common in July. Winds often attain gale force then subside gradually as the depression moves away to the east or northeast. The polar air in this northwest current has a steep lapse rate. These currents are often squally in nature and produce snow flurries in the winter and brief thunderstorms. In summer it is generally cool and showery, but will often turn into fine, anticyclonic conditions if the high to the southwest continues to build.

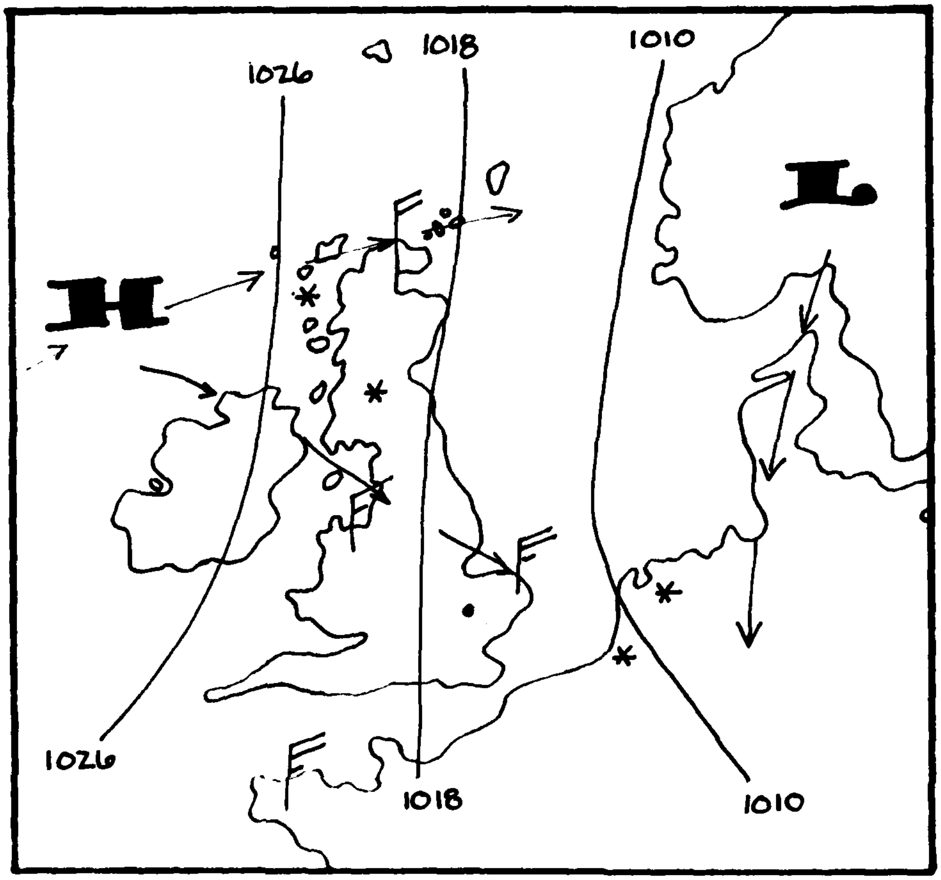


Figure 4-7. Northerly Type.

Type C: Low pressure to the east, high pressure to the west, causing northerly winds at Alconbury. This type is infrequent in all seasons and least frequent during the winter. This type produces the most bitter weather in winter. The passage of a low with a strong polar current of low temperatures is necessary to produce heavy snow at Alconbury. Strong winds from the north with broken to overcast stratocumulus (bases 1000 to 1500 feet) prevail. Winds may subside with the spreading of a cold high over England and very low temperatures will occur at night. A close watch is necessary because a shift to northeasterly flow can bring in North Sea stratus, snow, and sleet. A northeastward movement of the high may change the situation to type D.

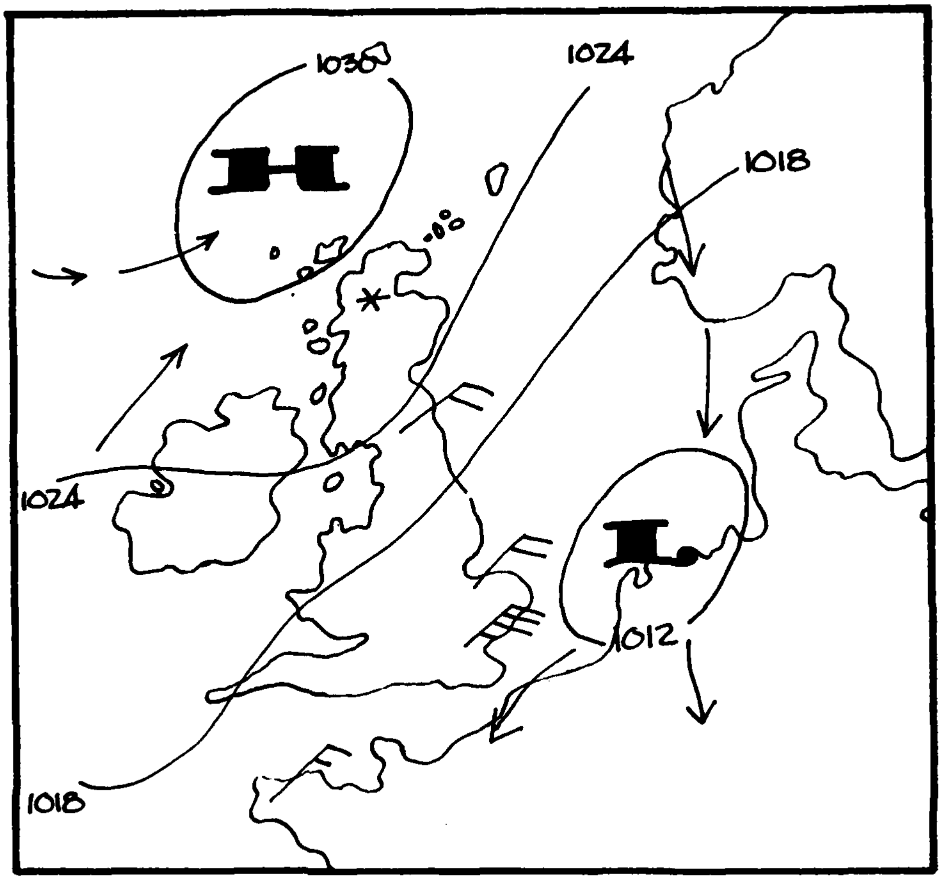


Figure 4-8. Northeasterly Type.

Type D: Low pressure to the southeast, high pressure to the northwest, producing east or northeasterly flow at Alconbury. This represents the complete reversal of Type A. It is a cold weather type most frequent in spring. Alconbury has low North Sea stratus from the Wash in the afternoon with ceilings 200 to 300 feet. If conditions don't break by 12Z the following morning, it will generally remain for another 24 to 36 hours. The difference between land and sea temperatures can produce persistent fog and lower visibilities less than 1/2 mile. Light rain or drizzle often accompanies this type. In such cases, conditions may be near or below minimums all day.

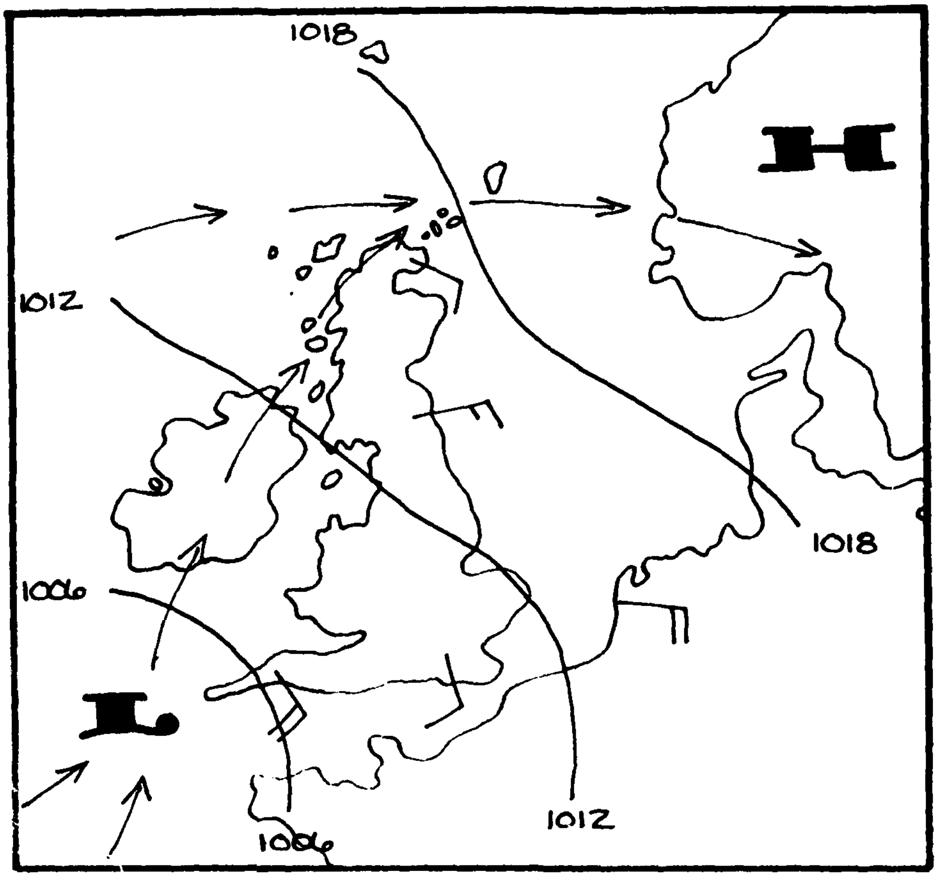


Figure 4-9. Southeasterly Type.

Type E: Low pressure to the west, high pressure to the east or northeast, producing south or southwesterly winds at Alconbury. This type is frequent in Autumn. In the summer the air is from a warm source region. Hot weather thunderstorms are very frequent, advected into East Anglia from France and moving across Alconbury during late afternoon. This generally occurs when the surface air is overrun by a cool, moist, southwesterly wind. This type is generally a dry air stream and visibilities are often reduced by industrial pollution from the southeast. Visiblities often lower to 1 to 2 miles at sunrise and sunset.

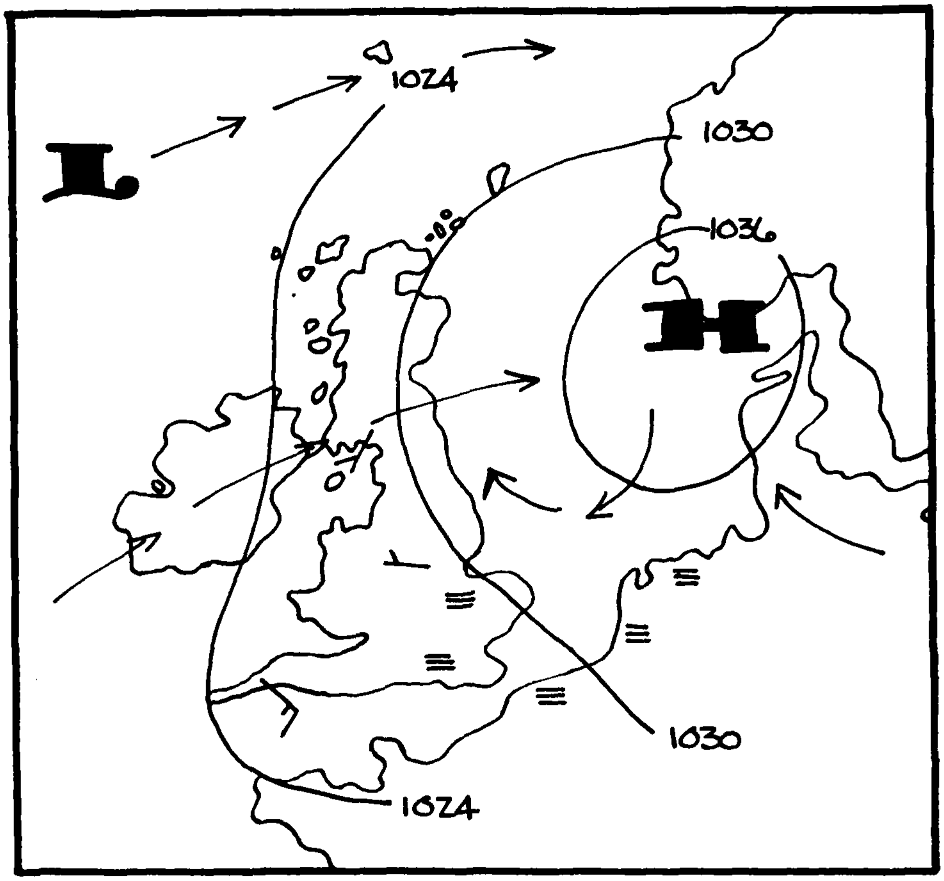


Figure 4-10. Anticyclonic Type.

Type F: This type occurs with considerable frequency at all times of the year and produces light winds and no precipitation. The lapse rate is usually slight and unfavorable for cloud formation. This type may persist long enough to give rise to drought. During late autumn and winter, the absence of air movement tends to produce fog. Low lapse rates under these conditions results in the confinement of smoke and pollutants in the low levels, reducing visibility. In summer this type gives high temperatures and low visibilities due to pollution.

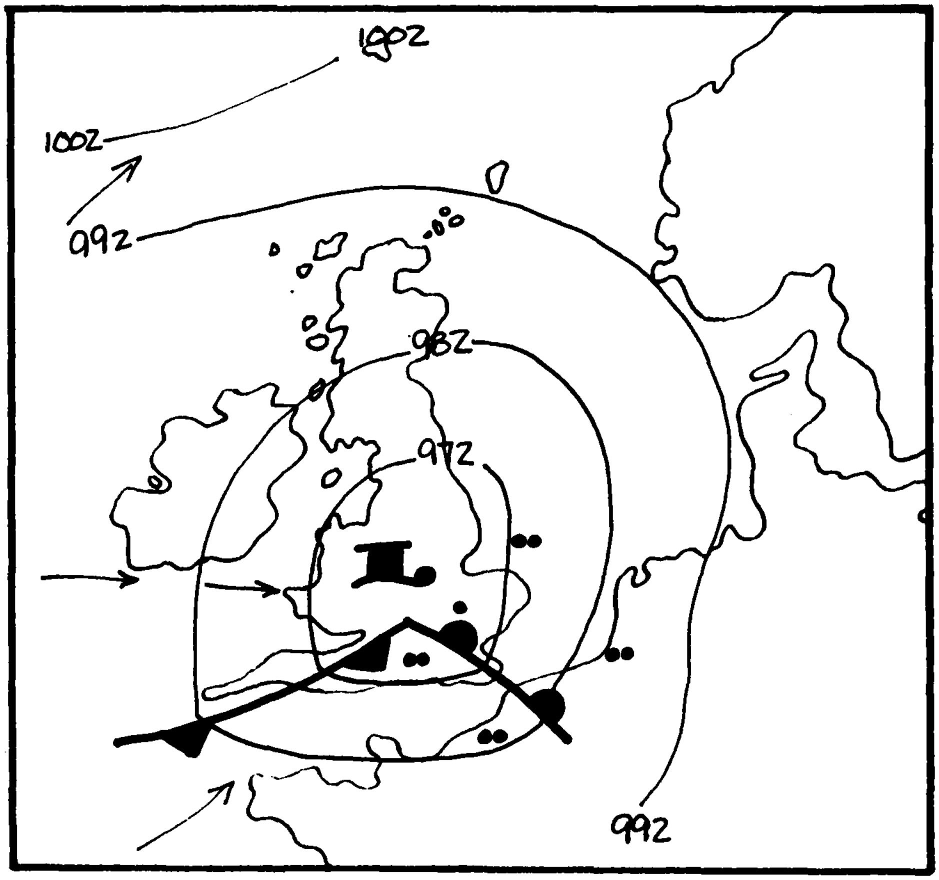


Figure 4-11. Cyclonic Type.

Type G: In this type, a low is situated either directly over the British Isles or near the mouth of the English Channel. These lows frequently cross southern England or move up the channel within a period of 24 hours, causing gales, heavy precipitation (occassional blizzards during winter), and general cyclonic weather. Many of the lows that cross England are associated with occluded fronts. When the low moves northeastward into the North Sea, we generally have ceilings at 500 to 800 feet, visibilities 2 to 3 miles, and moderate to heavy rain. Southwest winds often produce gale force winds with gusts to 35 knots or higher. Most of the rain is associated with the onset of warm air. The phenomena which accompany the passage of a well-developed cold front are more violent but usually brief in duration. Summer depressions are usually shallower and less intense than those in winter. This type has a very low frequency.

DEPARTMENT OF THE AIR FORCE
Detachment 36, 28th Weather Squadron
RAF Alconbury, England

TFRN
01 Jan 1983

TERMINAL FORECAST REFERENCE NOTEBOOK

This rewrite of the Det 36, 28WS TFRN supersedes all previous editions and incorporates all changes issued. This edition includes the addition of Barbera's Peak Wind Forecasting Technique in Section 3, Approved Local Forecast Studies and Rules of Thumb.

Clifford M Rudy

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